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CONGRESS has been advised that the Alaska Engineering Commission expects to complete the Alaska Government railroad from Seward to Fairbanks, in 1921. The cost is estimated at $50,400,000, or at the rate of $73,200 per mile. The mining public will welcome the completion of this important project, which will render accessible a rich and interesting part of the national domain.

ON June 28, at the very time when the Treaty of Peace was being signed, 900 Germans who had been interned during the War were shipped aboard the transport 'Martha Washington' on their return to Germany. They are said to have gone at their own request. Some 1800 others are due to leave on July 1. It might be well to make it July 4, as an item of celebration, for there can be no doubt that the departure of these anti-American elements is favorable to national solidarity.

FROM the columns of the 'Financial Times', of London, we get the news that Mr. Henry Gardner, formerly of Henry R. Merton & Co., Ltd., applied for a license to organize a new company of metal-brokers, but his application was opposed by the Board of Trade on the ground that his company would be "subject directly or indirectly in the conduct of its business to enemy influence or association," these being the words of the Act passed to deal with such cases. He appealed from the Board of Trade to the Court of the King's Bench and was awarded a favorable judgment, the Court stating that no evidence had been found to show "that Mr. Gardner intended to come under the influence or intended to associate with Germans" in his business. Indeed, the testimony all served to prove that, as the Public Trustee stated, "he was a thoroughly loyal and patriotic Englishman." Since this favorable judgment was given, Mr. Gardner, who is a Scot, has announced the formation of a metal-dealers company in association with other non-German former members of the Merton firm, and we wish him and them every success.

ENGINEERS Licensing Bills have been before the State legislatures of Colorado and California. In the Rocky Mountain State the bill was passed by the Legislature and signed by the Governor before the mining engineers heard about it. Nothing could be done to prevent the enactment, but the Governor was persuaded to appoint a Board of Examiners that would interpret the Act in a reasonable manner. The Board consists of Messrs. H. I. Reid, H. S. Sands, Frank E. Shepard, Robert J. Grant, and, *ex officio*, the State Engineer. We are informed that engineers from outside the State coming to Colorado to examine mines will suffer no inconvenience, whether they have a license or not, as the Board is in favor of using the soft pedal until such time as the next legislature shall have had an opportunity either to repeal or to revise the law. In California the mining engineers, in co-operation with other branches of the profession, introduced a Licensing Bill because the architects had attempted by legislative action to compel the employment of a licensed architect for the erection of any structure, thereby putting the engineer out of business except as the employee of an architect in the erection of mill-buildings, head-frames, power-stations, and the like, even down to the humble woodshed in a man's backyard. In order to circumvent this scheme all the engineers united in self-defence and introduced an Engineers Licensing Bill placing themselves on a parity with the other professions. This had the desired result, for both bills were withdrawn, the architects finding themselves euchred. Apparently this matter is settled definitively in California.

IN this issue we print the entire text of the presidential address delivered by Mr. Hugh K. Picard before the Institution of Mining and Metallurgy in London. It is well worthy of the large amount of space given it, as our readers will discover for themselves. Mr. Picard is a metallurgical engineer associated chiefly with the development of the flotation process, being the junior member of the firm of Sulman & Picard, whose name is attached to many patents, more particularly the one that has been the subject of so much litigation in this country. We like to think that if Mr. Picard had had the only say in the matter, the Minerals Separation company, with which his firm is so closely identified, would have adopted a less truculent policy. It is inconceivable that a technician capable of an outlook so scientific and philosophic, as that embodied in the presidential address, could have advocated the steps taken by the Minerals Separation company, in this country, to gag the profession. Whether we are right in our friendly surmise or not, the presidential address remains as a scholarly review bespeaking an intellectually generous mind and an accomplished metallurgist. What Mr. Picard says about the progress of the flotation process is highly interesting;

so are his remarks on the roasting of zinc ores and wet methods of extraction. He has kept in touch with American practice and is enabled thereby to present a comprehensive review of his subject. His references to the Delplace furnace, to the Cottrell and Halin processes, and to the Crowe method are to the point. We like what he says about the status of gold mining and the urgency for some measure of relief. In regard to secrecy in the art of metallurgy, and the paucity of information available concerning British methods, we venture to say—not without a smile—that Mr. Picard is throwing stones—and we approve of the throwing—from a domicile that looks to us very much like a conservatory. How much have he and his friends disclosed concerning the metallurgical methods in which they are especially versed? Evidently his admirable views on this matter are of an academic character and intended for non-domestic application. It is fair to note that he seems to be aware of the irony of his position, for he makes incidental mention of promised "contributions to the more scientific aspects of flotation." Hurry up, Sir! Something of this kind was said five years ago by some of your friends. "Art is long and life is fleeting." We note with considerable satisfaction that the advice given by Mr. Ingalls in a recent presidential address has greatly impressed his fellow-president in London, so we hope that even our less influential suggestions may impinge favorably upon Mr. Picard's eminently receptive mind. We thank him for the courageous note with which the address ends; that is the spirit in which the War was won, and it is the spirit in which all good work is accomplished.

APROPOS of our editorial on 'The Engineer as a Citizen' appearing on another page, we note that at the recent meeting of the American Society of Civil Engineers a report was submitted by the Committee on Development in the course of which sundry interesting recommendations were made. Among these was one embodying the local affiliation of the branches of the national technical societies and the local technical societies. In some degree this is being done already in San Francisco and Denver, for example, where joint meetings of members of all the technical societies are called on special occasions, as when a paper or address of special interest is to be presented. Next comes the suggestion to form a State Council composed of representatives from the local affiliations. This also has been done in California. For example, all the branches of engineering were represented in the steps taken to prevent the passage of an engineers licensing bill by the State legislature. We note also that "a short code of ethics of broad scope, general character, and positive rather than negative injunction, be prepared." That will be useful and interesting. It is highly desirable that the professional morale be maintained and the ideals of the profession be encouraged at a time when so many professional men are tempted to engage in questionable business for the sake of making money easily. A standard form of licensing bill is recommended to be used in the framing of legislation. If we must have a licensing law it will be well to have it uniform all over the country. The Committee finds that "the present practice with regard to expert testimony and arbitration is not satisfactory," an expression of opinion with which most of us will agree, and it suggests the co-operation of a committee from the four founder societies with a committee of the American Bar Association in order to develop a better practice. Yes, indeed; it is high time that technical witnesses, now special advocates, were engaged by the Court itself, not by the litigants, although the cost of engaging them might still fall upon the latter, equally. Another recommendation looks to the co-ordination of the Government's industrial activities under the direction of a Federal Department of Public Works. In this respect we are behind European practice; we load our Cabinet officers and Federal departments with an extraordinary medley of responsibilities; for example, the departments of War and of the Interior. The result is both extravagance and inefficiency in many directions, but not in all. We note, in conclusion, that, in accordance with similar action taken by the societies of mining, mechanical, and electrical engineers, it was decided to form a joint conference committee for the purpose of putting these ideas into effect.

DURING a mining dispute recently decided in Ontario, two interesting points were presented for adjudication by the Mining Commissioner, Mr. T. E. Godson. The first involved the legality of using old stakes for making a re-location. It appears that the ground had been staked many times previously and that the disputed location, of Mr. J. A. Knox, was made at night in order to obtain priority. The Commissioner said that he saw no distinction "between the re-marking of a post formerly used and the adoption, by the staker, of posts used by other holders, but upon abandoned claims." The old posts had ceased to have any legal value "and their usefulness passed with abandonment or forfeiture. The posts would no longer be the property of the holder of the forfeited interest or cancelled claim, and remained only as the mute testimony of a disappointed licensee." However, he considered the re-marking of such abandoned posts "a dangerous practice" and it behooved all licensees "to stake their claims so that possibility of attack upon the ground of defective staking is not left open." Another legal point arose out of the fact that the re-locating was done on a Sunday. It was claimed that the staking by Mr. Knox was abortive because it was contrary to an Act of Upper Canada "to prevent the profanation of the Lord's day" and an Act of the Dominion making it unlawful "for any person on the Lord's day . . . to sell or offer for sale or purchase any goods . . . or to carry on or transact any business . . . or to employ any other person to do on that day any work, business, or labor." The Commissioner decided that the prospector is not "a workman or laborer" in the sense of the first enactment and, as to the second, Mr. Knox made his discovery "without work or labor." The discovery had been made already. A locator in

Ontario must comply with the Mining Act of that Province; he must perform his assessment work under that law; neither Sunday nor holidays are excluded; each day counts equally in the respective periods allowed for his assessment work. The ground became open for location after October 12, which was a Saturday. "The property was undoubtedly Crown lands," said the Commissioner, "and open for staking, and there was no prohibition in the license from the Crown restraining or prohibiting such an act on Sunday." He went further in his ruling, he considered the calling of the prospector and the consideration due to him by society. "A prospector," said he, "who separates himself from the comforts and protection of society, blazes a trail into unknown mineral zones and discovers mineral of value, is serving not only himself but the public at large, and no unnecessary restraint should be placed upon his activities." He could understand a prospector being forgetful of the day of the week; he could appreciate the necessity for haste when the grubstake was running low and the prospector was far from a source of supplies. We can understand these considerations also, and we regard the ruling as both sensible and humane. The Commissioner, however, does not encourage Sunday work, if avoidable. He said: "I confess a desire to abstain from finding that to stake a mining claim on Sunday creates an invalidity through the operation of the Lord's Day Act, and yet I wish to be understood that Sunday should be observed as a day of rest and calm when the mind can be dissociated from worldly tasks. Nature, however, has its own quieting influence and provides 'books in the running brooks, sermons in stones, and good in everything'." Yes, indeed; the prospector can, and often does, worship in the great cathedral, whose dome is the blue sky, whose aisles are of the forest, where the pines bend their heads in prayer and the winds of heaven make music for the listening ear.

Peace

It was the idea of peace rather than the terms of the treaty itself that gave joy to the world on June 28. The guns that boomed and the bells that pealed on Saturday last echoed the thankfulness of mankind that the long and cruel war was at an end legally. To most of us the event was a sad anti-climax, for seven months of growing impatience and disillusionment had elapsed since the joyous moment when in the darkness of a November night we had celebrated gratefully and enthusiastically the end of the fighting and the signing of the Armistice. Little then did we realize the difficulties and delays inseparable from the completion of the necessary negotiations; little did we comprehend the complexity of the international problems created by the disintegration of Europe. We realize and comprehend all that now, and it should increase, rather than decrease, our appreciation of the labors performed at Paris. We regret the absence of the Chinese delegates at the last ceremony and we feel some sympathy with General Smuts in his protest against the Shantung settlement, of which President Wilson's enemies will make the most, but any fair-minded man will recognize the practical impossibility of adjusting a thousand and one conflicting claims without giving offence to one or more of the nations concerned. Most of all we regret the growing irritations expressed by the Allies and their Associate after the finish of their victorious campaign against German brutality. United against the foe in the height of conflict, they have failed to keep their tempers or to maintain their comradeship since the crisis has passed. One has boasted too much, another has been jealous, a third has been too grasping, a fourth has adopted a pose of selfish detachment—we do not describe any member of the group, but we instance the pose assumed by various ones in turn—until the splendid solidarity of the fighting days has given place to dissension on the very eve of the final settlement. If the world is to benefit from the peace we must change our mood and determine to work together generously, not only for the establishment of the League of Nations and the continued development of the idea expressed by the Covenant, but we must try earnestly to evoke a larger measure of international charity. We Americans are too provincial, almost as provincial as some of the others; much of the petty spirit shown today, even by the returning soldiers, is the result of that provincialism; we must take care lest the labor-unions develop a false internationalism—one based on class feeling—before we acquire one founded on a better basis. For the internationalism of the proletariat, which aims to destroy national spirit, we have no use whatever, believing that the best cosmopolite is he who loves his own country above and beyond all others; and the highest type of such patriotism is shown not by the ignorant or the unimaginative man but by him who knowing, respecting, and even loving other countries and other peoples, still loves his own country as a man loves his own mother. The treaty records the punishment of Germany and the fulfilment of the purpose that brought 26 nations into alliance against the unscrupulous effort to dominate first Europe and then the world. It is a warning to international piracy and to militarist ambition. We may see other wars in the days to come, but it is safe to predict that wars of conquest such as those of Frederick the Great, Napoleon I, and William II will never be allowed again to make headway. The League of Nations is imperfect necessarily, and it may not succeed in all its good intentions, but it is reasonable to expect that it will serve to check any further attempts at world domination. We think the President justified in speaking of the Treaty of Peace as "a charter for a new order of affairs in the world." Certainly it does "associate the free governments of the world of affairs in a permanent league in which they are pledged to use their united power to maintain peace by maintaining right and justice." It will not be smooth sailing; there will be squalls; but we have a chart now to help us in steering through darkness and storm, and if the ship's company will only try to restrain their natural impetuosity we may hope to reach smooth waters and keep on the course of human progress toward the distant haven

of a peaceful way of living. So we welcome the signing of the Treaty thankfully, and on this consummation of the national effort, and of the Allied effort, we rise in deep respect and profound gratitude to salute the heroic dead by whose valor our purpose has been achieved.

The Engineer as a Citizen

This was the subject of a symposium held recently in the Engineering Societies Building, at New York, under the auspices of the local sections of the four founder societies of engineers and of other technical organizations. Mr. Gano Dunn, an eloquent speaker, was chairman of the meeting. Mr. Philip N. Moore, who needs no introduction to our readers, took as his text 'The Responsibility of the Engineer' and started by saying that the engineer has awakened to the fact that he is "not politically potent," because he rarely serves politically nor has he usually developed the political sense. This is due in part to his migratory habits, 'themselves the consequence of short-lived engagements and discontinuous work over a field not limited either by county or State, nor even by national boundaries. Failing to make local ties or to assume local responsibilities, he has little sense of civic duty except spasmodically in times of crisis, such as in the War, when he rose to the occasion in an exemplary manner. Another adverse factor is found in loyalty to, or in discipline enforced by, big corporations, many of which have interests adverse to the public and therefore expect their engineers to keep out of politics. We agree with Mr. Moore, whom we are paraphrasing; it is noteworthy, for example, that the technical men employed by the big smelting consolidations show no more than a formal interest in the vexed questions of the hour. The talking is left largely to the heads of the organizations and they usually have little to say except when their pocket nerve is touched. Their juniors, the progressive technicians, are bound, by rule or etiquette, we do not know which, to a discreet silence. We venture to say that our profession has lost something of its character during the last two decades by reason of the fact that the big corporate mining and smelting enterprises have aggrandized themselves exceedingly and have tied the most capable members of the profession to themselves, making them a part of a business organization in which liberty of political action is difficult, if not altogether impracticable. The number of independent consulting engineers is small and most of them are not independent from choice. Again, the tradition that engineering societies must hold themselves aloof from political affairs—a view held strongly, for example, by Dr. Raymond—has discouraged participation in civic duties and in discussions upon public questions. On top of these checks and timidities the engineer is inarticulate publicly, because, with rare exceptions, he does not cultivate the ability either to write or to speak effectively, particularly the latter, which is essential to the exercise of influence upon one's fellows. That this entails a great loss to the community no thoughtful citizen will deny, for the mental training and the varied experience of the engineering class, in the doing of things and in the directing of men, represent an asset of inestimable value to the commonwealth if applied to municipal, State, or national affairs. At a time when loose thinking is as dangerous as loose dynamite, at a time when a hysteria of political sentimentality is undermining the very foundations of representative government, it is more than regrettable—it is pathetic—that the engineer should not bring his disciplined mind to the service of society. During the War the need for joint action by the engineering societies became recognized, the result being the creation of the Engineering Council, which, since May 1917, has been able to express the best engineering opinion of the country on matters of administration and legislation at Washington. At the close of the War the Engineering Council appointed the National Service Committee, of which Mr. M. C. Leighton is chairman, to keep an eye on legislative measures affecting engineers and on matters of public welfare connected with engineering. This is a step in the right direction. Mr. Calvert Townley, of the Electrical Engineers, raised the question whether it would be possible for the engineers to be "a technical organization and a political party at the same time." Obviously "a united body of technical men" might, by political passion, become disintegrated unless guided sagaciously. The time may come when the technical institute as such will be distinguished from, and supplemented by, the larger organization intended to promote professional solidarity and co-operation. The movement toward a union of the existing societies and the evident tendency to form one national engineering organization is in large measure a result of war conditions and of the national spirit evoked during that stirring period. To the engineer as a citizen in a republic such a consolidation would give a political power he never had before, but it might tend to relegate purely technical subjects, now the principal topics at the periodic meetings, to a secondary place. Even that prospect should not appal, for a place will be found for technology at special meetings, and if we sacrifice something to good citizenship we shall be better engineers. We are inclined to agree with Messrs. Farley Osgood and J. E. Johnson, Jr., both of whom took part in the symposium, that the education of the modern engineer is so specialized that he misses the generous training of the humanities; he has no time for the study of his own language or of the classics, for history or philosophy, because he wants to give his time to the special studies that prepare him for the winning of a livelihood or the gaining of a fortune. He emerges a specialist, rather than a well educated man. In consequence, his mental scope is so narrow as to make him politically impotent. After all, there lies the trouble. As bends the twig so grows the tree. We sacrifice culture to bread and butter. We make an efficient specialist at the expense of an effective citizen. When we recognize that a good citizen is more valuable than any 'ologist, we may begin to produce him in larger numbers.

DISCUSSION

A Primitive Sun-Dial

The Editor:

Sir—On a recent professional trip through the mountains of northern Sinaloa in Mexico I came across the following curio at the home of one of the Indians. This man could neither read nor write and was of the typical type of Indian who inhabits that part of the country. He was by profession a wood-cutter, and I was much

surprised to find in his little yard a sun-dial, which I photographed. It consisted of a post set on an incline, from the top of which was nailed a bottom of what had once been a lard pail, and in the centre of this a long wire-nail was driven. Well-defined scratches on the circumference of the tin disc in connection with the shadow made by the nail indicated the time of day. You will note the shadow caused by the nail. The picture was taken at about a quarter past four by Mexican Federal time, and it was not so very far out when the proper corrections were applied.

I questioned the Indian whence he got his knowledge, and he stated that the method of determining the inclination of the post and the marking of the disc had been known in his family for "ages," as he expressed it. I tried to get him to describe this method of doing it, but I was no wiser at the end of his discourse than when he commenced. The fact remains that here is your sun-dial and it gets results, which, from an engineering standpoint, was interesting.

LOUIS T. GRANT.

San Francisco, June 11.

The Leaching of Flotation Concentrate

The Editor:

Sir—In reply to Mr. E. M. Hamilton's letter in your issue of June 21 on the above subject, I have pleasure in answering his questions in the order given.

(1) The tests at the Edwards metallurgical works were conducted with the object of determining the best methods of treatment. While percolation gave satisfactory results, the time required for the operation makes it advisable to use the Dorr system of counter-current decantation in a plant treating more than a few tons per day.

(2) I have proved by experiments that over 90% of the acid-soluble copper can be dissolved in a few seconds by adding hot calcine, as discharged from the furnace to the lixiviant. Therefore dissolving-tanks are not required preliminary to the Dorr counter-current system. This opinion is confirmed by Lawrence Addicks in the Transactions of the A. I. M. E., Vol. LII, 1915.

(3) I refer to the danger of incomplete washing of the pulp between copper extraction and cyanide treatment for gold and silver. I thought the fact that the final washing out of gold and silver can be successfully performed was sufficiently well known to prevent any misunderstanding when I referred to incomplete washing.

(4) If roasting is conducted under the most favorable conditions for copper extraction, the silver in the calcines will be in the form of the sulphate and metallic silver. In confirmation of this statement I quote 'Experimental Leaching at Anaconda', Transactions of the A. I. M. E., Vol. XLIX, 1914.

(5) The chlorination of residues from copper-leaching was successfully performed on a large scale at Mount Morgan, Queensland, by means of a solution of chlorine in water, the operation being conducted in large open tanks. I propose a modification of this process.

(6) The ores on which the experimental work was conducted did not contain sufficient silver to warrant extraction by a separate process, but a few experiments were conducted on the residue from chlorination and the greater part of the silver was found to be in the form of the chloride.

(7) The working-costs given for gold and silver extraction apply to chlorination followed by water and 'hypo' treatment. In the case of the gold both the extraction and costs were compiled from figures obtained in working-scale tests, but the figures for silver were assumed.

The extraction of the silver is the only step in the process that has not been thoroughly demonstrated, but in view of the results obtained at Anaconda by an oxidizing roast followed by an acid-brine leach, I cannot see that this is an unsurmountable difficulty.

I would like to point out that the experiments outlined in my article were conducted on concentrates from a number of Australian mines and not exclusively on Mount Lyell mill-products.

PERCY R. MIDDLETON.

Salt Lake City, June 24.

The Gwin Mine

The Editor:

Sir—I wish to correct an erroneous news-item that appeared in the June 14 issue of your valuable paper, relating to the Gwin mine. Evidently your correspondent did not know the facts concerning this great property.

The surface plant of the Gwin Mine Development Co. was sold more than a year ago, when machinery of all kinds was in great demand and brought war-time prices. The company deemed it good business to dispose of it, as much of it would have to be replaced with modern electrical equipment because it was worked out, as stated; it was a question of power conditions that closed the mine. Of this I will not go into details other than to say that it was most unfortunate for all concerned.

As to the conditions of the mine, the engineer's last report showed that the mine had developed more ore, and of a better grade, and looked more promising than it had for many years previous to closing down. There is developed in the bottom of the mine, ore-shoots of a combined length of over 450 ft. that show an average assay-value of more than $10 per ton, and there are other hundreds of feet of ore that give assay-values up to $5 per ton. These splendid orebodies are practically intact, as the mine when closed had not been placed in condition to extract this ore. In addition to these newly developed orebodies in the bottom of the mine, there is known to be a very large tonnage of ore available in the upper levels of the south shaft of the mine. Two-thirds of the mine has not been prospected and very little cross-cutting has been done. The contact with the greenstone was never reached on either the east or west side. All of the ore encountered was found in the slate. The Gwin mine has been as rich in places as any mine on the Mother Lode, and has had as long chimneys of payable ore as any. One chimney was over 1600 ft. in length of continuous pay-ore averaging from 4 to 8 ft. thick. In other places the ore was over 20 ft. thick for many hundreds of feet.

About a million tons of ore was mined and milled by the present company. In addition to paying liberal dividends, the original cost of the mine, the cost of hundreds of acres of added territory purchased by the company, and the entire cost of the plant was paid for out of the profits of the mine. The Gwin has produced about $5,500,000 in gold. The stock has been closely held and was never placed on the market. The mine owes not one cent to any investor, and it is safe to predict that when this splendid mine re-opens, as it will some day, it will give a good account of itself.

F. B. MOORS.

San Francisco, June 21.

Ptomaine, or Botulism

The Editor:

Sir—In your issue of June 14 you mention the death of 12 out of 36 guests at an Alaskan dinner and state the cause as ptomaine poisoning. It would be of great interest to know details of the food eaten and its condition. The danger from ptomaine poison is well known and is usually ascribed to spoiled meat or fish. It is not so well known that spoiled canned fruit or vegetables may be equally deadly. Botulism is the disease brought on by such spoiled canned fruit or vegetables; it occurs within a few hours or may be delayed as much as nine days. It is stated that this disease caused the Alaska deaths and not ptomaine. Great muscular fatigue, eyes affected even to blindness, diarrhoea, and nausea are among the symptoms. On the Pacific Coast ten cases were reported in the six months ended May 1918, and in all 19 cases have been recorded; death took place in two-thirds of these cases. In November 1913 out of 12 persons who ate string-bean salad at Stanford one died. At Fallbrook, five died after eating canned apricots. A woman and 40 chickens died at Hillsboro, Oregon, after eating canned corn. In Darmstadt, Germany, 11 died out of 21 persons who had eaten bean-salad. A peculiarity of the disease is that the mere tasting of canned food has caused death; a Miss B. of Ontario, Oregon, tasted a jar of canned string-beans and concluded that they were not "exactly right." She died in 52 hours.

The disease is due to toxins generated by the bacillus botulinus. Boiling the food from 15 to 30 minutes destroys the toxin and renders it harmless. The disease although rare is worth bearing in mind and whenever there is any doubt as to the goodness of canned food it should be boiled for 30 minutes.

W. H. SHOCKLEY.

Palo Alto, June 16.

Note: An intensive study of botulism is now in progress at the laboratory of experimental medicine at Stanford by Mrs. G. S. Burke, to whom I am indebted for the above information.

THE ROCHESTER COMBINED MILL, ROCHESTER, NEVADA

Ball and Tube-Mill Drives at the Rochester Combined Mill

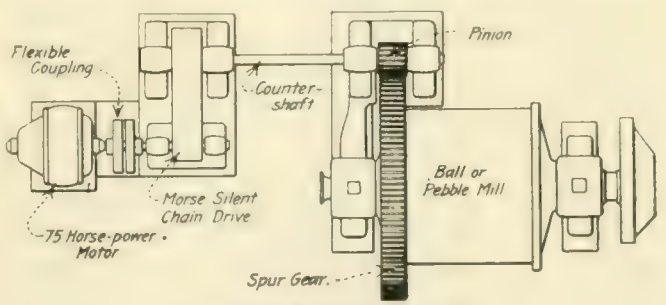
By K. FREITAG

The grinding elements in the Rochester Combined Mines Co.'s mill at Rochester, Nevada, are arranged in two units, each composed of one 6 ft. by 4 ft. 6 in. ball-mill and one 7 by 12-ft. tube-mill.

The ball-mills are fed from two cylindrical bins by apron-feeders that discharge into the centre-fed scoop-feeders mounted on the feed-trunnions. The size of the ore particles fed to the ball-mills is 1½ in. All the mills are of the overflow type employing no screens in the discharge end, but the trunnions are equipped with reverse-spiral liners. The ball-mills use forged-steel balls as a grinding medium, and the new balls fed through the central feed-opening are 5 in. The pebble-mills use flint, which is fed through the centre opening in the scoop in the same way as the balls. The ball-mill discharges its product to a duplex Dorr classifier operating in closed circuit with the pebble-mill, the pulp being ground so that 80% will pass a 200-mesh screen.

The feature of the equipment is the main-drive arrangement. Many designs of ball and tube mill-drives have been put into operation, and every known method of transmission has been employed, but nearly all have developed serious faults after a few months of continuous operation. From the early application of the long-belt drives to the later short-centre or Lenix drives, many variations of belt-drives have been applied. Of all belt-drives the long-centre straight drive has proved the best, but it requires considerable floor-space and is an obstruction where closed-circuit grinding is employed. All belt-drives involving a friction-clutch to reduce the starting torque introduce an accessory that is weak mechanically, as the strain on the clutch is extremely heavy when starting the mill from rest, even if rocking the mill is attempted.

With the introduction of closed-circuit grinding it was necessary to develop a short-centre drive. The first tried was a double-gear reduction, using a friction-clutch and constant-speed motor. Later, a chain-belt was used in place of the first-gear reduction, and finally, a single-gear reduction by means of herringbone gears. All these drives were objectionable either in the methods of application or under-rating the excessive strain on them; but the main trouble was that due consideration was not given to the end-surge which occurs in all ball and tube-mills, no matter how well they may be balanced. The bearings cannot be set close to the trunnion-collars, as clearance must be allowed for contraction and expansion



PLAN OF BALL-MILL DRIVE

of the mill-barrels. This is particularly the case with the longer tube-mills, in which the grinding temperature varies. In shorter mills, where it is possible to set a new mill with only slight clearance, the wear and tear of daily use will soon be noticeable.

It can be seen readily that this end-surge will seriously affect direct or single reduction gearing. The speed of the driving-shaft prevents it from following the jerky surge of the mill, and therefore causes excessive side wear on the driving-sprockets. In order to overcome the objectionable features embodied in the drives mentioned it was decided to eliminate them in order as they occurred. That this was accomplished has been demon-

strated by the continued successful operation of the mills during the past year.

In the illustration it will be noted that the general design is identical for both ball and tube-mills. In order to secure interchangeability of parts, it was decided to build both mills as nearly alike as was possible, although the diameters were different. All trunnions and trunnion-bearings were made 24 in. diam. by 24 in. long, giving an extra large bearing-area and also providing large trunnion-openings. The trunnion-liners were made interchangeable as well as the feeders and discharge-spouts. This idea of interchangeability of parts was carried through to the motors and the entire drive arrangement. The motors were built on the same frame, thereby making all bearing-shells interchangeable. The switchboard and control apparatus were made identical with the exception, of course, of the grid-resistance.

The selection of motors to take full advantage of the desirable features of the drive was carefully investigated and it was determined finally to use motors of the Westinghouse CW type. These are phase-wound motors designed especially for good starting characteristics and high running efficiency with windings carefully braced to resist the vibrations incident to tube and ball mill-drive. A further advantage was that the Westinghouse company could supply motors of 75 and 100 hp. for the ball and tube mill-drives, respectively, built on the same frame so that all mechanical parts would be interchangeable. The ball-mills are driven by 75 hp. 585 r.p.m. 440 volt, three-phase, 60-cycle type CW motors and the tube-mills by 100 hp. motors of the same characteristics. Each motor is provided with a control panel of the Westinghouse type RF, style No. 245,374, equipped with suitable starting resistance. These RF panels are supplied with an ammeter, a primary circuit-breaker with overload trip and under-voltage release, as well as a drum-controller behind the board with a hand-wheel mounted on the face of the panel. The ammeters enable the operator to know at all times just what his mills are doing, and he is accordingly able to adjust his ball charge to get the best results. The RF control-panel has a special feature in that the operating mechanism of the motor starting-controller is interlocked mechanically with the primary circuit-breaker so that if the circuit-breaker has once tripped it cannot be closed again until the controller has been returned to the 'off' position.

On each motor-shaft is mounted a 24-in. Nordberg flexible coupling connecting the motor to a short shaft that carries the driving-sprocket for the chain-drive. This shaft is of the same diameter as the motor-shaft and is mounted in two rigid pedestal bearings supplied with ring-oiling removable bearing-sleeves interchangeable with the motor-bearings. These pedestals were furnished by the Westinghouse company. A heavy cast-iron sole-plate forms the base for the above bearings as well as for the main counter-shaft bearings, and as all bearings are provided with means for lateral adjustment, it forms a rigid base on which it is possible to maintain perfect alignment for the chain-belts.

The driving sprockets and chains for the ball-mills are as follows:

75 hp., 48-in. centres, reduction 585 to 160 r.p.m.

Driver-sprocket 21 tooth, 9¼ in. face, 10.02 in. diam., hardened steel.

Driven sprocket 77 tooth, 9¼ face, 37.03 in. diameter.

Chain, Morse type, 14.5 ft. long and 9 in. wide, 1.5 in. pitch.

The driving-sprockets and chains for the tube-mills are as follows:

100 hp., 50 in. centres, reduction 585 to 138.5 r.p.m.

Driver-sprocket 21 tooth, 12¼ in. face, 10.02 in. diam., hardened steel.

Driven-sprocket 89 tooth, 12¼ in. face, 42.75 in. diameter.

Chain, Morse type, 15.75 ft. long and 12 in. wide, 1.5 in. pitch.

Both of the above drives are enclosed in a galvanized iron case provided with hand-hole and oil-drip rings.

The main countershafts for the ball and tube-mills are $5\frac{1}{16}$ in. diam. mounted in heavy mill-type ring-oiling bearings. The two bearings next to the main pinion are mounted on a heavy cast-iron sole-plate which is tied to the main trunnion-bearing at the discharge end of the mills, ensuring perfect alignment of the main drive. The other end of the shaft, on which is mounted the driven sprocket, is carried in heavy ring-oiling bearings, similar to those on main-drive end, and mounted on the sole-plate, which also supports the bearings carrying the motor-shaft extension.

The main drives for the ball-mills are as follows:

Driving pinion cut cast-steel, 15 teeth, 3½ in. pitch, 14 in. face.

Driven gear close-grained cut semi-steel, 100 teeth, 4 in. pitch, 14 in. face.

Main drives for tube-mills are as follows:

Driving pinion cut cast-steel, 16 teeth, 4 in. pitch, 14 in. face.

Driven gear close-grained cut semi-steel, 100 teeth, 4 in. pitch, 14 in. face.

Both main-driving gears are made in halves and bolted to the end flanges of the mills in such a way that they can be easily removed or turned around, so that both faces of the teeth can be used. The speed of the 6-ft. ball-mills is 24 r.p.m. and of the 7-ft. tube-mills, 22 r.p.m.

This drive arrangement with all bearings mounted on interconnected sole-plates ensures perfect alignment of all the shafts. The employment of cut spur-gears, chain-drives, flexible couplings, and slip-ring motors is considered by the designers to be superior to any other drive arrangement for ball and tube-mills. The chains are relieved of all excessive strains and run perfectly, without the customary jerk so familiar in the old type of drives. Any undue strain or surge of the mills that is not absorbed by the cut main spur-gears and is transmitted to the chain-sprockets, due to slightly worn collars on the main shaft, does not affect the running of the chains; as this motion is not counter-acted by the motor, but is absorbed by the flexible Nordberg coupling connecting the motor with the floating motor-extension shaft.

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PRESIDENTIAL ADDRESS, BY HUGH K. PICARD

Introduction. In addressing you tonight I propose to follow the course taken by my predecessors in giving a brief survey of recent metallurgical progress, in so far as such has come within the purview of my particular work, concluding with some remarks of a more general character on matters affecting our industry. In normal times it would be a simpler task to follow and record such developments, but the War has imposed entirely new conditions which increase the difficulty of a review, such as secrecy (in order to prevent leakage of information to the Enemy), urgency (wherein economics have been thrown to the winds in the materialization of a desired military result), an entire re-grouping of the factors of chemical and metallurgical supply and demand, and, finally, the promise of revolutionary changes in regard to labor.

As to the first of these it is to be hoped that, as the necessity for secrecy no longer exists, many of the great advances in technical and metallurgical science evolved under the stimulus of war may now become known for the early benefit of our national industries.

Further, it is much to be desired that such industries as have sprung up in response to our urgent necessities (other than those concerned with the production of purely war material) will not only be retained by us, but will continue to develop to the advantage of the country and the nation. Certain of these have been re-created in an artificial atmosphere of State support or subsidy; several, with such assistance, having reached a stage of technical efficiency, it appears to be of vital importance that further encouragement should be afforded them for such periods as will secure their permanence or of their requiring a minimum of external support.

Tungsten. A typical example of this is the tungsten industry, about which so much has been made public. Even the non-technical reader is now familiar with the general facts regarding this metal, while a certain amount of information as to its production has also become known through the technical press. It will be sufficient for me to refer to Julius L. F. Vogel and A. F. MacLaren, whose able work resulted in the production of this essential metal—essential not only in war, when its supply was a vital necessity to the country, but also in time of peace. Its importance is well expressed by the American metallurgist, Colin Fink, who says: "It may some day be said that tungsten made democracy possible." Through the efforts of these metallurgists and their associates we are now independent of foreign supplies and, moreover, the quality of the British production is superior to that previously imported from Germany.

Flotation. In regard to recent metallurgical advance during the past few years it will probably be conceded that the practice of flotation has brought about greater progress in metallurgy than any other single invention. At the inception of the froth-flotation process in 1905, oils, such as oleic acid (then deemed to be insoluble), were used. As careful analysis showed the mineral so frothed to be intimately associated with the insoluble oil employed, the impression was gained that this had uniformly coated the particles which had been floated, and that the air-bubbles had become attached to such oiled particles. As the amount of oils used was relatively minute, say 2 lb. to the ton of ore, while the aggregate surface of the particles oiled is enormous, calculation showed it to be questionable whether an oil could be distributed *qua* 'oil' in such extreme tenuity and still retain its original physical properties.

With the discovery, some four years later, that other and wholly-soluble frothing-agents were found equally and sometimes even more efficacious, the conception that oil was primarily essential to frothing was necessarily modified, and the process became more widely known as that of 'froth-flotation'. With later discoveries as to the partial solubility of essential oils, of the beneficial effect of certain insoluble oils in 'stabilizing' the froths and of sub-aeration procedure, the elimination of any need for pulp-heating, or in many cases for acidification, together with the use of alkaline circuits, etc., modern flotation has made remarkable advances.

Broadly speaking, the essential conditions for effective flotation appear to be that the material to be floated must be capable of flocculation, while that not to be floated must be brought as nearly as possible to the reverse state. This is achieved by the addition to the ore-pulp of reagents which by adsorption or sorption at the surfaces of the various particles increase such differentiation. Acids, alkalis, and certain alkaline salts act in the direction of wetting the gangue by water more profoundly, producing a deflocculation effect, whereas the adsorption or sorption of a minute amount of an immiscible oil at the mineral surface renders this still less capable of being wetted by water, and thus stabilizes a mineral-coated bubble in water.

The water-soluble portion of an oil, or a water-soluble substance such as cresol, amyl alcohol, etc., reduces the tension of water, and thus permits the latter to form an extended froth surface for occupation by the less water-wetted floatable mineral. Certain oils may thus pay a dual part in flotation. Variations in ore constitution—both physical and chemical, in the nature of the water, in choice or limitation of reagent, and in local conditions generally—are so wide that each one will present a flota-

tion problem of its own, requiring individual study. Where the factors are so varied flotation must in large degree remain an art, as well as a growing science. This condition, however, governs applied science generally, and metallurgical processes form no exception to the rule.

I understand that contributions to the more scientific aspects of flotation may be expected shortly, which will, no doubt, go far to elucidate the fundamental principles on which the process is based.

Since the outbreak of war flotation methods have been widely, indeed almost universally, adopted. During this period, the greatly extended use of this process in the United States is the most notable feature, and it is hardly too much to say that concentration practice has been revolutionized; in addition to the increased recoveries of mineral due to the ability of this method to deal effectively with slime, its adoption has led to a general simplification of concentration procedure, with a corresponding reduction of working cost.

In modern installations, such as that of the Inspiration Consolidated Copper Co., at Miami, Arizona, where the plant was specially designed for flotation, the current practice is to limit the units to the smallest number possible. At this mill the ore, first crushed by disc-crushers, is passed to tube-mills, working in closed circuits; the pulp is then immediately sent to flotation units with the consequent elimination of all intermediary steps in the concentration. The re-treatment of any middling products and the enrichment of the primary concentrates is also effected by flotation, resulting in a simple flow-sheet.

Froth-flotation has developed the use of settlers and vacuum-filters, which are now indispensable units in concentration plants adopting this process. The settlers are in some instances employed for the re-utilization of plant-water, and in others for the thickening of concentrate prior to vacuum-filtration; their usual size is from 30 to 50 ft. in diameter, but in some instances settlers of over 200 ft. in diameter are in use. The shallow 'tray' settler is also employed where the physical character of the ore permits; these consist of units 3 to 4 ft. in depth superimposed on a common shaft to economize space and secure increased capacity.

Similar progress has marked the evolution of the flotation-units themselves. In the Minerals Separation type, for example, the driving gears have in some instances run continuously for over three years. These units are self-regulating, the supply of reagents being automatic, so that in practice it is not uncommon to find one man per shift operating units dealing with between 3000 and 4000 tons of ore per 24 hours.

Everywhere the tendency is toward the elimination of hand-labor; thus, besides ore, the concentrate and tailing are handled by settlers and belt-conveyors, whereas the grouping of all units is designed with the object of reducing labor, space, and construction cost to a minimum. The result has been a reduction in cost which, in many instances, has rendered obsolete the best of the older gravity concentration systems.

Some comparative figures as to the advantages of flotation may be of interest. The total tonnage of ore treated by water concentration at the Anaconda plant from February 1902, to December 1915, was approximately 36,000,000 tons, carrying 1,250,000 tons of copper, of which the actual recovery was approximately 900,000 tons. In 1916, flotation was installed, from the results of which it is estimated that had it been used during the earlier period 175,000 additional tons of copper would have been saved, capable of realizing, less cost of treatment, a further profit of nearly £8,000,000. In 1913, when water or gravity concentration had attained perhaps its high-water mark of efficiency, the five largest disseminated copper mines in the United States produced approximately 162,000 tons of copper, but discarded about 83,000 tons in tailing, the average recovery of copper at these mines being about 66%; had flotation been employed it is now demonstrable that their increased recovery for that year alone would have exceeded £3,500,000. In its turn, however, flotation has introduced new smelting problems, mainly due to the fineness of the material to be handled; the International smelter, at Miami, which now represents the latest copper-smelting practice in America, has been specially designed to deal with this type of concentrate. Hand-labor here has also been practically superseded by mechanical appliances; specially designed cars handle the concentrate and facilitate loading and unloading, prior to its passage to the roasting-plant. The roasters are fired either by oil, or coal-dust, the latter having now proved the more economical; the Cottrell process here becomes a necessary adjunct, preventing dust losses with practical completeness. Again, progress in one department of metallurgy has imposed conditions which have led to improvement in another, thus the cost of smelting the fine concentrate, originally so difficult to handle, is now reduced to between 5 and 6 shillings [$1.25 to $1.50] per ton of charge.

Though the theoretical principles underlying flotation are still unsolved, progress in this direction is being made and it is one of the most remarkable features of this process that its use has been so greatly extended while its full scientific basis is yet unestablished. Callow, whose contribution to the technique of the art deserves special mention, calculates that with four different oils, three oil-percentages, two pulp-densities, and two changes of temperature, the possible commutations are no less than 59,284. This gives some idea of the difficulty experienced in arriving at the effect of any given change of conditions, but in spite of this over 400 flotation plants have been installed on the North American continent alone.

Zinc. Passing to the metallurgy of zinc there has not been any marked improvement of first importance in smelting during recent years, though general advance in matters of detail may be recorded. The problem of the mechanical roasting of the ores cannot yet be considered as completely solved, especially for the more refractory type, such as Broken Hill concentrate, which forms so large a proportion of the world's supply of raw material.

Though improvement has been effected in this direction, as exemplified by the Ridge and Spirlet furnaces, it is significant that in the latest zinc works to be erected in this country, the management have adopted the hand-rabbled Delplace furnace as being the type best suited to their requirements. These works, situated at Avonmouth, are being constructed by the National Smelting Co., and are designed for an ultimate output of 50,000 tons of zinc per annum. These, when completed, with extensions of other existing works, should go far toward establishing the industry in this country on a much sounder basis than existed before the War. No effort is being spared to make the Avonmouth works thoroughly efficient and up-to-date. The general arrangement is well designed, and provision is made for future extensions. The pottery has a capacity of 45,000 retorts, and is arranged for convenient handling in and out; two hydraulic pot-presses are to be installed (one of which is already erected), which will supply the retorts for the 16 retort-furnaces contemplated. These are of modern gas-fired type, the retorts being arranged in four rows, back-to-back. The air is pre-heated in regenerative chambers under the furnaces, and are protected from injury due to slag from broken pots by the interposition of a layer of chrome-iron ore between the regenerators and the retort-chamber. Five gas-producers are provided for each pair of furnaces, two being in regular use for each furnace, the fifth being a spare one which can be turned on to either furnace as may be required.

Though Delplace furnaces are being installed for roasting, the management is erecting one of special design, upon the results of which future additions will depend. The former are of large type, having six muffle-hearths each with 18 sections, and should be capable of dealing with 20 tons of raw concentrate per day. Special care has been taken in the design to ensure easy renewal of the hearth as required.

The acid plant, of platinum 'contact' type, was originally built by the Government, and has been used for the manufacture of sulphuric acid from Sicilian sulphur. With the necessary additions for cleaning the roaster gases from arsenic, etc., this plant will be available to deal with the sulphur di-oxide evolved from the 20 roasting-furnaces it is proposed to erect.

In view of the present high cost both of labor and material and the improved extraction now called for, much attention has lately been given to the question of treating retort-residues for their metallic contents, both as to still contained zinc, and other metals such as lead and silver, if present. It has been proposed to blow such residues on Wetherill grates, but this yields a mixed product of zinc oxide and lead sulphate and affords only an incomplete elimination of the silver. Other objections are the inferior quality of the product (due to a certain amount of fine grit being carried over with the fume), while if silver be present the blown fume acquires a pinkish tint, rendering it unsuitable for paint purposes; further, the silver, both in the fume and the ultimate residues, is lost. In the absence of silver, a market exists for the zinc oxide-lead sulphate product, if free from grit and carrying about 20% of lead; such a mixture makes a paint of covering power superior to pure zinc-white, besides being cheaper. For ores of a less complex character, 'blowing' the residue offers fair possibilities, and it has even been proposed to modify the usual distilling practice in the direction of only recovering the more easily distilled portion of the zinc, calling for the employment of a smaller amount of reducing coal and leaving a richer zinc-residue for blowing. Such a procedure would increase the capacity of the distilling-furnace and result in longer life of retorts, as they would not require to be submitted to the high final temperature necessary to drive off the last units of zinc.

WET PROCESSES for zinc extraction with the subsequent recovery of the metal by electrolysis have now become firmly established; Ashcroft's pioneer work in this direction will be remembered. The conditions necessary for success, notably roasting at a low temperature to avoid the formation of insoluble ferrite, and the subsequent perfect purification of the solution are now well understood, the latter condition being demanded by the necessity for keeping the deposited zinc in a passive state to prevent re-solution. As a necessary consequence electrolytic zinc will always be highly pure compared even with the re-distilled zinc producible from retorted metal. Much discussion has taken place as to the possibility of the electrolytic process displacing the older method; but it seems probable that for some years to come both processes will survive, and that local conditions with regard to nature of ore, power-cost and facilities, etc., will determine which method shall be adopted for any particular case. It may be said for the electrolytic process that it certainly permits the utilization of low-grade and complex zinc ores which could never be available to the retort process. As an example, the Consolidated Mining & Smelting Co. is treating ores by this method at Trail that assay as low as 20% zinc and carry 14% of lead. Further, combination dry-and-wet processes are likely to develop wherein the zinc oxide (and lead if present) are concentrated as a 'fume' for subsequent treatment by solution of the zinc followed by electrolysis. Such methods have the advantage of yielding a zinc solution requiring the minimum of purification, while leaving other metallic contents in a form recoverable by smelting.

At Anaconda, Laist has proceeded in a reverse direction, by first extracting roasted flotation concentrate with acid, electrolyzing the purified solution, and treating the residue by volatilization in a reverberatory furnace, the contained zinc being recovered as oxide. According to recently published information, Laist no longer recovers the zinc by volatilization, confining this operation to the saving of the lead, while the zinc passes into the slag. How far this is due to more perfect original extraction of the zinc in solution in the previous operation is not stated.

These developments are due in large degree to the work of American metallurgists, who have at their dis-

possess large supplies of ores of varying character offering scope and opportunity for special methods of treatment. But in this country also zinc has been regularly produced by electrolysis from ores, though on a smaller scale; given, however, equal opportunity we may certainly claim to possess the necessary technical knowledge to compete with foreign producers.

The War brought about a large demand not only for the highly-pure electrolytic zinc of 99.95% grade, but also for metal of 99.9% purity obtainable by the re-distillation of ordinary brands, and even of 'hard' spelter, which contains about 90-92% zinc, the remainder being mainly iron. The method chiefly adopted in this country was devised by Fricker, who distils the metal in vertical closed crucibles provided with connecting pipes leading into a brick condensing-chamber common to a number of pots, generally eight. The lead and other impurities are prevented from passing over with the zinc-vapor by covering the surface of the molten metal with a floating filter of crushed coke, or similar porous material. By this process large quantities of refined metal have been produced for cartridge-brass and other purposes. How far the demand for high-grade zinc will persist for ordinary commercial uses is uncertain. For most alloys containing a substantial percentage of zinc, as also for galvanizing, ordinary brands of spelter are sufficiently pure: hence consumers are not likely to pay the higher price demanded for 'purity' metal.* The latter will therefore have to compete with G.O.B., and producers may perhaps be forced to accept a price only greater in proportion to the higher unit of the purer product.

Zinc Oxide. Before leaving the subject of zinc metallurgy, reference may be made to the manufacture of zinc oxide in this country. Before the War practically the whole of our requirements were met from Continental and American sources; indeed, our secondary products were in some cases bought by German firms, exported to the Continent for treatment, and the zinc-oxide produce again sold to us. War conditions have since brought about the establishment of a domestic zinc-oxide industry; and, as in other cases, we now produce this material of a quality equal in all respects to that hitherto imported. Works capable of producing 50 tons or more per week are running regularly, and, given reasonable protection against unfair competition, there seems no reason why the whole of our requirements should not henceforward be met from domestic sources.

The oxide is manufactured by distillation of hard spelter, scrap, etc., with subsequent burning of the volatilized metal to oxide, which is collected in bag-house plant in the usual way. Technical details as to pipe arrangements, fan-capacities, etc., have been worked out, and the conditions necessary for the production of the highest quality product have been established. No doubt there will still be competition from American oxide, produced directly from ore, owing to the lower cost of the raw material employed. This oxide, though of inferior color, is suitable for many purposes, such as rubber filling; moreover, it possesses the advantage of high density. Oxide production from ores and residues though not yet established in this country is being investigated, and there is reason to anticipate that this may eventually prove successful.

In South Wales zinc-dust ('zinc blue') has recently been manufactured direct from metallic scrap and a product obtained which is far superior to that derived as a by-product from the retort process; the latter usually contains about 85% of active zinc, whereas the former carries not less than 95%. The demand for high-grade zinc-dust in the dyeing industry is large, and, owing to its superior reducing value, it should have a good outlet in gold-precipitation.

The prepared fume is screened in a flour-miller's bolting machine; owing to its granular character no difficulty is experienced in screening. The product though excessively fine is uniform in size of particle and free from dust; under the microscope each grain is seen as a brilliant metallic sphere. A word may be said as to the perfection of the bolting machine for screening fine powders; this has been developed to meet the stringent requirements of the corn-milling industry and if better known would no doubt find application in screening dry crushed ore.

A wider general knowledge of the practice of industries other than our own would, I believe, lead to the discovery of many appliances which could be adapted to our special needs. For example, the filter-press was well known to the potter before its value was recognized in ore treatment. He has, from our point of view, the worst possible type of clayey material to filter and in addition contamination by iron rust must be avoided; hence he adopts a press with wooden frames. We could perhaps reciprocate by introducing to him the vacuum-filter and pulp-thickeners.

Pottery. While on the subject of pottery an interesting application of gold may be referred to, though this perhaps comes rather within the province of chemical industry than metallurgy. It is not commonly recognized that the gold decoration of cheap pottery consumes a large amount of the metal in such a manner that it never returns to the market. The gold-line decoration on cheap cups and the 'solid' gold handles on cheap 'ornamental' vases is in fact gold of almost the highest degree of fineness employed in the arts. The compound as employed consists of an organic salt of gold in an oily medium, and as applied does not contain more than about 6-9% of metal. The desired decoration is painted on the otherwise finished ware, which is then heated to about 700°C., far below the melting-point of gold. Over 90% of the compound, consisting of the oils and medium, is thus burnt away, leaving the perfectly uniform coherent film of gold with which we are all familiar. The metallic components consist essentially of pure gold, but modified to the extent of about 1% with other metals, which brings about the brilliant metallic film; and it is

*The galvanizer would prefer pure zinc if obtainable at a reasonable price, as a more durable product results from its use.

interesting to remark that if absolutely pure gold be employed no such film would result, the effect being instead a dull earthy pink deposit. This affords another example of the influences of a small amount of a foreign metal on the mass, a feature so frequently met with in almost every branch of metallurgy. So coherent is the film, in spite of the loss of over 90% of the original compound, that it may be used as a satisfactory base for electro deposition thereon of another metal, such as silver, for decoration or other purposes. Platinum behaves in a similar manner, and it is possible that for certain purposes porcelain dishes coated with gold or platinum by this means may be of service in the laboratory.

As another illustration of borrowing from other industries, the metallurgical furnace-builder may derive much assistance from the glass industry and *vice versa*. Oil-firing, now so commonly employed in smelting, is well known to the glass-maker, who may have experience in its use not generally known to the metallurgist. My object in the above remarks is to call attention to the advantages which must result from a freer interchange of knowledge and experience between our various industries. To this end one of our leading societies, the Society of Chemical Industry, has in normal times an annual program of visits to various works, giving members the opportunity of inspecting operations in which they are not directly interested.

COPPER. For developments in the metallurgy of copper we naturally look to the United States. Thanks to the publicity given to progress in the States and to their excellent technical publications, we have been made familiar with recent advances and it thus becomes unnecessary to refer to them in detail. Among such, reverberatory practice (due to the ever-increasing amount of flotation concentrate to be smelted) may be mentioned. In this connection the increased throat-area, with correspondingly larger burners for oil or coal-dust firing resulting in largely increased output per furnace, should be noted. The El Paso 130-ft. furnaces burning oil have reached a daily capacity of over 960 tons with a consumption of 0.61 barrel of oil per ton. Leaching of oxidized copper ores by ammonia, so often suggested in the past, has come within the domain of practical metallurgy. For example, it is reported that the Calumet & Hecla Mining Co., in a plant treating 2000 tons of tailing per day, is recovering copper at a total cost of 6.25 cents per pound, with a loss of only one pound of ammonia per ton of ore. Further developments have also taken place in acid-leaching plants in connection with which A. W. Halin's process deserves mention. He passes the acid solution through a number of ore-charges until the solution becomes neutral. It is then delivered to a tank containing fresh ore whereby the ferric iron is precipitated, whence, after acidification, the solution passes to the electrolyzing plant for precipitating the copper. The treatment of ore in heaps by leaching, following Rio Tinto practice, is also being extended in America.

In this country the industry cannot be said to be flourishing, though in spite of war conditions, and partly because of them, some notable achievements have been effected. One instance of overcoming a serious difficulty may be cited, as showing the adaptability and resourcefulness of our metallurgists. In this case the ores to be smelted demanded the addition of pyrite, hitherto imported from Spain. Owing to the requirements of the Government for Spanish pyrite for acid-making this source of supply was cut off, threatening the closing down of the smelting operations. A new and hitherto neglected supply was, however, developed by the manager (one of our members) from the pyrite seams of the Welsh collieries, and it is satisfactory to record that this source now meets all the requirements of the works, not only for sulphur, but when calcined it is available as iron flux for smelting oxidized ores. The neglect to make use of this supply in the past is no doubt due to the reluctance of colliery proprietors to admit the existence of sulphur in their mines, as it might reflect on the quality of the coal. However, they now recognize that they have in pyrite an asset of value; moreover, it now pays to mine coal-seams rich in pyrite that hitherto have been left. The pyrite is recovered by hand-picking on belts. In the result the copper-works now secure ample supplies at a cost considerably below that previously paid for Spanish mineral; it is strange that this material has been overlooked by acid-makers in spite of the great demand created by the War.

As producers of copper we can, of course, never expect to compete with the United States, but, given a measure of State assistance, we ought to be in a position to secure for treatment a fair share of ores and matte from our own Dominions. For this purpose increased electrolytic refining capacity is certainly needed, but until some security for the industry be assured there is no inducement to capital to embark in such undertakings. The ever-growing demands of labor, with consequent increase in the price of raw materials, unless checked, must inevitably tend to drive the industry to countries where easier conditions prevail. The recent heavy fall in the price of the metal due to over-production, and the withdrawal of consumption for war purposes, calls for economy in every direction; it also points to the necessity for State action, failing which it is difficult to see how the industry can survive.

THE METALLURGY OF GOLD, in so far as it relates to the recovery of the metal from its ores, shows general improvement, but nothing of first-rate importance except perhaps Crowe's method of precipitating cyanide solution under reduced pressure. He shows that the air dissolved in the solution, has, owing to the different coefficients of absorption, a composition of 35% of oxygen and 65% of nitrogen, and consequently is a more active oxidizing agent than air of normal composition. He points out that in weak cyanide solutions, consequently with a minimum of hydrogen being generated, the oxidizing action of the dissolved oxygen largely neutralizes the reducing action and may even overcome it. In normal practice this is met by adding lump cyanide at the head

of the precipitation box, with consequent increased consumption of both cyanide and zinc. By the adoption of the vacuum process this practice is unnecessary and extraction may be effected with weaker solutions resulting in savings in all departments, including the production of a purer bullion. The Portland Gold Mining Co. reports a saving of $30,000 per year in zinc and cyanide in a plant treating 2000 tons of ore per day. It is interesting to note that G. T. Hansen claims similar advantages by heating the solutions to 170°F. before precipitation.

Concentration of gold ores by flotation is making progress, but the field for this process is somewhat restricted, owing to the general high efficiency of the older methods. At Cobalt flotation has replaced gravity concentration, although at the Nipissing mine this process has been rejected, not on account of its inefficiency, but because of the difficulties in subsequent treatment of the concentrates. On complex gold-silver concentrate involving further treatment, the advantages of flotation compared with ordinary concentration followed by cyanide are not so manifest. The value of flotation as a means of increasing the world's output of gold lies rather in improved recovery of base metals, such as copper, with which gold is so commonly associated.

With reference to the production of gold, and more particularly to the question of a bounty, this is a matter for settlement between the economist and the producer. It is a subject upon which so many varying opinions have been expressed by authorities that it is difficult to arrive at any decided conclusion. So far as our own direct interests are concerned, a bounty on gold would be an obvious benefit, as we have many members engaged in this industry, though the objections to this course are also weighty.

A committee of the council of the Institution appointed to report on the position of the gold output of the British empire made an exhaustive inquiry into the subject, and issued their report in March 1918. This shows that a reduction of 20% of the Empire's gold production is visibly imminent, and this at a time when the need for gold is ever more pressing.* There can be no two opinions as to the vital importance of not only maintaining but also increasing our gold supplies, and with the object of effecting this the committee recommend a 10% bounty on the output of all struggling mines or alternatively a bounty of two shillings [48c.] per ton of ore treated. Proposals on these lines, however, were not acceptable to the Government Gold Production Committee.

It seems self-evident that unless relief in some form be granted, the production of gold must necessarily fall by the stoppage of the lower-grade mines; apart from the influence this would have on the general economic position, as to which opinions vary, a serious injury would be done to gold mining as an industry. Lord Inchcape's committee, however, is not disturbed by the prospective stoppage of these mines, and does not consider such an eventuality to be of any great importance to national interests.† Although there may be objections or difficulties in the granting of a direct bounty it would not appear impossible to concede some remission of taxation, and to this extent relieve the industry of some of its unfair burden. We already have a precedent for such action; children are considered to constitute a valuable asset to the State, and in principle, though to a very slight extent, taxation relief is granted to the producer. Why, therefore, should not similar action be taken in regard to gold?

LEAD. In the metallurgy of lead, also, recent advances seem to be in detail rather than in fundamental improvements. In the stress of recent years there has been small opportunity of developing new processes in industries that are well established on recognized lines, such efforts being rather devoted to specialties called for by the War. Mention, however, may be made to progress in hydrometallurgy, as applied to oxidized lead ores. This has been limited to brine treatment with or without the addition of sulphuric acid to carbonate and sulphate ores. This process has been tested in America as well as in North Wales, where a small plant was working until the difficulties of obtaining supplies caused a temporary cessation of operations. In this case the material to be treated consisted of an extensive dump of blende and lead sulphate slimes. Vanner concentration yields a mixed product of no value until further separated. This is effected by agitating the concentrates with hot saturated brine at 70°C., whereby the lead sulphate is completely dissolved, with, of course, the equivalent formation of sodium sulphate. The presence of this salt in growing proportions interferes with the solubility of the lead sulphate, and must therefore be removed by the addition of the equivalent amount of calcium chloride. The lead solution is filtered from the blende-calcium sulphate residues, and precipitated with slaked lime, reforming a portion of calcium chloride; about 50% of the chloride is regenerated, the balance of the chlorine being precipitated with the lead as oxy-chloride. The blende-calcium sulphate residues are then re-treated on a vanner, which effects perfect separation of the easily removed flocculent sulphate, leaving a saleable blende concentrate. The chief objection to the process lies in the chloride present in the lead precipitate involving volatilization loss in smelting, but this may be overcome by precipitating the lead by electrolysis, using soluble iron

*The accuracy of this forecast is shown by a recent question in the House of Commons in which the Chancellor of the Exchequer was asked if he was aware that there had been a drop in the gold production of the British Empire of 13½% in the year 1918, compared with 1915, and that the world's production showed a drop of 20% in the same period. The figures given were not questioned.

†Since these words were written the Chancellor of the Exchequer has stated: 'There is nothing in the report of Lord Inchcape's committee to suggest that producers of gold are not entitled to obtain for their produce the best price available in the most favorable market, and I am now considering in what manner this can be secured.'

anodes. This process is limited in its usefulness by the relatively small quantity of material available and by its inapplicability to silver or gold contents. It may, however, develop in the direction of the treatment of low-grade sulphide ores, after a sulphating or chloridizing roast at a temperature low enough to prevent the volatilization of the lead chloride.

In the province of general metallurgy the increasing use of the Cottrell process deserves special mention. As an example of painstaking research in developing a practical process from a long-known but unused scientific fact it has few equals. We have to go back to 1870 to the work of Dr. Tyndall for the first disclosure of the phenomenon on which the process is based. This was further examined by Frankland, Lord Rayleigh, and Oliver Lodge; but for the useful application of the principles involved, we had to wait for Dr. Cottrell. He first applied the method to depositing sulphuric acid mist produced in the contact process, and is still being used for this purpose. It is satisfactory to report that the merits of the invention have been recognized in this country, the first plant to be erected here in 1917 being at one of the Government acid-plants. It is also in use here for the precipitation of fumes from metallurgical works, following established practice in America; its further extension in this country seems certain. The advantages of the process are far-reaching; not only are valuable products recovered, but agriculture in the neighborhood of the operations is saved from serious damage. We are glad to congratulate Dr. Cottrell on receiving the Perkin medal as a recognition of his valuable services to industry.

THE METAL INDUSTRY. In considering the position of the metal-producing industry before the War, one cannot but be struck with the apathy of the Government in regard to a matter of such vital importance to our security. It is true that as soon as the seriousness of the position was realized, energetic steps were taken to meet the situation. That within such a comparatively short time the difficulties were overcome is a striking tribute to the ability and energy of the technical men in this country. Industries were created and developed in a period of months which had been the subject of many years' growth on the part of foreign producers; not only were we able to produce articles equal to those obtained from abroad, but in many cases higher standards of purity and efficiency were achieved. The production of high-grade tungsten already referred to is an example of this, while in other directions the manufacture of magnetos and optical glass has reached a state of perfection unsurpassed by makers possessing prolonged experience.

These facts demonstrate that our position in pre-war days was in no sense brought about by lack of technical knowledge or skill, though it has been usual to refer to our inferiority in this direction, as well as to lack of initiative and energy, as being the true cause. The experience of the War shows this view to be unfounded, and that given reasonable facilities and the absence of official and fiscal discouragement we can, so far as technical knowledge is concerned, place ourselves in the front rank as producers of all essential materials. This charge having been proved to be baseless, it is clear that in order to maintain our position as producers some protective steps must be adopted; failing this, there is every reason to suppose that our new or revived industries will relapse into their pre-war inefficiency. It is reported, for instance, that efforts are being made to re-introduce foreign glass into this country, which if successful (unless effected under conditions which will protect our own manufacturers) cannot but tend to harm, if not to destroy, an industry which, under war conditions, has succeeded in re-establishing itself.

I am, of course, referring here only to such industries as were either non-existent or were in a struggling state, and this condition obtained largely in the production of certain essential metals. This possibility has been officially recognized, and committees have been formed to examine into the problems and make recommendations. Lord Balfour of Burleigh's committee on commercial and industrial policy after the War has made an exhaustive inquiry into the subjects covered by the Terms of Reference. A study of the committee's final report reveals the complexity of the subject. The departmental committee's report on the iron and steel trades ascribes the relatively stationary condition of this industry in part to deficiency of our iron-ore resources, but primarily to greater efficiency of German and American methods.

A point is made of the individualism of the British character which prevents the manufacturer from "pooling his brains and capital to the greater ultimate advantage of the industry." This would appear to be a just charge. It is well known that with few exceptions large amalgamations are not looked upon with favor in this country, where moreover every effort is made to maintain secrecy in regard to working processes and operations generally. I cannot say from personal knowledge how far this applies to the steel trades, but it is very evident in other metal-producing industries. I am satisfied that nothing but benefit would result from removing the restrictions to open discussion which persist in this country. We should do well to open our works to the visits of technical men interested in the subject, as this would inevitably result in the exchange of experience and information to mutual advantage. The present attitude is certainly not dictated by the technical managers, who as a body would welcome such an interchange of knowledge, but are excluded from this benefit by the action of their employers.

W. R. Ingalls, in his admirable presidential address before the Mining & Metallurgical Society of America this year, says on this subject: "One of the cardinal principles of American engineering during the last 20 years has been the exchange of information and the promotion of publicity about everything—technical processes, business relations, corporate affairs. We have seen America forge ahead largely owing to the absorption of this idea, while Great Britain lagged behind. . . . She is wide awake now."

It is to be hoped that the awakening referred to has indeed taken place. Apparently this secrecy is not confined to our own special branch of industry. C. F. Cross, in 1916, on the occasion of the presentation to him of the medal of the Society of Chemical Industry, said: "He was particularly aware of the difficulties which they had encountered, especially that of being between the crossfires of the commercial or financial man whose watchword was secrecy and the scientific man whose disinterestedness, perfectly natural and spontaneous, led him always to wish to publish in order that he might communicate what he had found in his laboratory to his fellow scientific men. . . . They . . . were always most anxious to take counsel with their brother chemists, and give them the benefit of anything that had impressed them, just as they looked to hear of any new discovery by others at the earliest possible moment."

This condition is reflected in our own Transactions (and to a less extent in our technical journals), which contain but little information on important undertakings in this country. In analyzing the papers published in the last ten volumes of our Transactions, I find that 35.8% deal with mining in foreign countries and our dominions and colonies. Foreign, etc., metallurgy supplies 17.3%; assaying and analysis 15.0%; general 27.7%, whereas British mining in these islands is confined to a solitary paper, and British metallurgy to six papers, or 3.5% of the whole. It is true that some of the general papers find application here, but the record can only be considered as unsatisfactory in that it fails to present in any adequate manner important operations which we know are being conducted. I hope these remarks may have some effect in removing the veil of secrecy which overshadows our undertakings.

Reverting to the committee's report, the Departmental Committee (iron and steel) favors combination both in production and in realization of produce, but is also of opinion that protection in some form is required to give security to industry. Other departmental committees report on similar lines, ten such being in favor of a tariff, while three (representing the cotton, jute, and shipbuilding industries) report against. The main committee is by no means unanimous on the point, but it should not be beyond the capacity of the Government to reconcile the conflicting views, and decide on the course most advantageous to the country as a whole. It would be out of place and indeed superfluous to discuss the well-worn arguments for and against tariffs, though it would probably be found that the majority of the members have very definite views on the question.

Though the committee leans toward protection it expresses the fear that such might result in stereotyping inefficient methods, but in my view there is little ground to support this. I anticipate, on the other hand, that the feeling of security engendered by a suitable degree of protection would stimulate producers to adopt modern methods involving capital expenditure which under present conditions they decline to risk.

The committee is strongly of opinion that State control will be found detrimental to peace conditions, a conclusion with which most will agree, though recent action in regard to both coal mines and railways does not encourage the hope that this opinion will find favor. It is also eminently satisfactory that they agree with the resolution adopted by the Imperial War Conference as to the formation in London of the Imperial Mineral Resources Bureau. Much of the foundation work of the bureau has been accomplished, and there is good ground for anticipating that the hopes of its promoters will be realized.

It was my intention to discuss in some detail certain aspects of the problem of reconstruction in so far as our special interests are affected, but these have been so fully and carefully analyzed by W. R. Ingalls, in his address already referred to, that little remains to be said. I am in no sense detracting from the merits of his remarks when I say that he is addressing those who are already converted, but few have the knowledge and ability to put the case so succinctly and convincingly. It is earnestly to be hoped that it may come into the hands not only of Labor leaders, but of those in control of Government departments having relations with mining and metallurgical matters. Naturally he deals mainly with American affairs, but his arguments bear with equal force on conditions existing here. He makes reference to these, but in my view his opinions on our position are somewhat too sanguine. He will pardon me for giving one or two extracts. He quotes the view of an American visitor to this country, who says:

"England is knitting together for work. The directors of capital and organized labor were never more together. . . . England is studying efficiency and is preparing for overseas competition."

Mr. Ingalls himself says:

"We have seen how Great Britain practically lost important metallurgical industries . . . and we see her now keenly studying and introducing improvements that will . . . not unlikely put her ahead of us."

It will be admitted that there is some tendency in this direction, but the union and progress foreshadowed are still far from achievement. No doubt his reference to conditions in Europe are designed primarily to stimulate the efforts of his own countrymen. The ever-growing concessions of shorter hours at higher pay must be carefully watched in their effect if we are to maintain our position against foreign competition. From this point of view it is almost a matter of satisfaction that similar claims are being put forward in America.

Mr. Ingalls in his masterly address shows the economic fallacy underlying such demands as have recently been pressed. I take the liberty of making two more quotations: the first, addressed to the American engineer, has equally forceful application to ourselves:

"First of all, what I see is that the engineer should saturate himself with sound economic doctrine. This is just as much the basis of his professional work as are the sciences of physics and chemistry."

The second will, I hope, reach the class to whom it aptly applies:

"The social reformer, who does not understand production, is a far less important person in the promotion of human welfare than the engineer who does."

The principles he lays down as to the general economic position apply with perhaps greater force to this country, since we are to so large an extent dependent on overseas countries for our supply of raw materials.

It is beyond my capacity to forecast the future of metallurgy in this country. Our industry is suffering in common with many others from the lack of any clear indication of the fiscal policy of the future. The Minister of National Service and Reconstruction has certainly stated that all raw materials required for national industries would be admitted without restriction, but whether this applies only to the reconstruction period or is to be the final settled policy, seems uncertain. So far as his statement goes it indicates that ores, which are essentially raw materials, will be admitted freely, and to this extent the smelting industry would benefit; but if metal, such as spelter, which may be looked upon as raw material from the galvanizer's point of view, is also included in the list we may have a hard task to hold our own. In regard to this, however, there is ground for a hopeful outlook, as he also intimated that industries which it was essential to foster would receive a measure of protection in some form. I think it will be admitted the production of metal is among such industries.

Regarding the labor situation, we are, I think, justified in anticipating that the Industrial Conference will lead to greatly improved relations between Capital and Labor, though up to the present some of the more important groups have held aloof from the Conference. It is to be hoped that legislative effect will be given promptly to the proposals and that the National Industrial Council will be the means of promoting and maintaining industrial peace.

Though the future may be beset with difficulties it is not the time to take pessimistic views, but rather to use every effort to meet them and to accommodate ourselves to the new conditions brought about by the War. Shakespeare puts the following lines into the mouth of King Henry V when in a position of difficulty before Agincourt:

". . . 'tis true we are in great danger;
The greater therefore should our courage be.
. . . . . .
There is some soul of goodness in things evil
Would men observingly distil it out."

It is in this spirit that we must go forward, striving if possible to extract the small essence of goodness which may, after all, be extractable from the vast slough left to the world as a war legacy.

GOLD PRODUCTION of the Lena property in Siberia, during 1916-'17—the latest figures just to hand—was 380,273 oz. from 569,513 cu. yd. of gravel. This return was well up to normal. As the mines are 5000 miles from Petrograd, and 1000 miles from rail, Bolshevism did not affect the community in that year.

Oil-Land Valuation

A bulletin on the 'Decline and Ultimate Production of Oil-Wells, with Notes on the Valuation of Oil Properties', by Carl H. Beal, has just been issued by the U. S. Bureau of Mines. One of the most vexing problems that confronts petroleum producers and petroleum engineers is the estimation of the total amount of oil that may be obtained from the oil-wells and from oil-lands, and the rate at which the future productions may be obtained. This is a problem upon which much thought has been given and much work been done in the past, but it has only been within recent years that it has been brought down to a rational engineering basis. The bulletin of the Bureau of Mines is a record of the work done by many engineers with much information in advance that has been developed by the Bureau of Mines. It is obvious that an estimate that is reasonably reliable is an extremely valuable bit of information to the producer, to the prospective buyer, to the pipe-line companies, and to refiners depending upon certain sources of supply, and for the purpose of determining depletion allowances for book-keeping or taxation. In the past this has usually been done upon the personal judgment of the producers of wide experience, though many of the principles employed in this bulletin have been used consciously or unconsciously by producers; as, for example, observing the rate at which production falls off. The bulletin is the result of a rational and systematic compilation and analysis of records whereby essential principles and facts are established and the factor of personal experience and judgment is almost eliminated.

The bulletin outlines old and new methods for estimating the output of oil-lands and gives numerous curves and other data which should be of great assistance to oil producers and engineers in determining the probable amount of oil that a property might yield. The problem of the application of methods of oil-valuation is covered and explanations given in the use of methods in computing depletion allowances in book-keeping and in taxation. The bulletin should do much toward developing scientific methods for the buying and selling of properties, amortizing capital investment, and in estimating future productions of properties in the United States.

TIN PRODUCTION of Tasmania during the past four years was 2256, 2637, 2855, and 4010 tons, respectively. This is oxide, carrying 70% metal. The industry employs 1260 Australians. The largest producers last year were Mt. Bischoff (lode) with 458 tons, Briseis (alluvial) 321 tons, Pioneer (alluvial) 264 tons, Mt. Bischoff Extended (lode) 155 tons, and Royal George (lode) 112 tons. From 1880 to 1918, inclusive, the total output of the State was 126,846 tons of oxide, valued at £13,236,078 ($63,100,000).

AMORPHOUS GRAPHITE to the amount of 6560 short tons, valued at $69,455, was sold from mines in Colorado, Nevada, and Rhode Island. The output of amorphous graphite in 1917 was 8301 short tons, worth $73,481.

Electric Hoisting Equipment at the Butte & Superior Mine

By OLIVER E. JAGER

The present electric hoisting equipment at this company's mine at Butte, Montana, has now been in operation about two years, steam-hoists having been employed prior to this. The installation of the new hoists is so closely connected with the history of the mine itself that it is of interest to review briefly the course of events.

The mine is in heavy ground; faulting is frequent, and there is considerable movement of ground. On account of these factors the old shaft had got into such bad condition that it was decided to sink a new shaft and equip it with a new hoist. This brought up the question of the 'chippy' hoist, which had been run unbalanced, and hence with heavy consumption of power. To reduce this power consumption it was suggested to run the chippy with a counterweight, but on developing the idea it was found better to substitute a cage for the counterweight, which meant another compartment in the shaft. The plan of the proposed new shaft embodying all these features now showed that it was entirely too large for the prevailing conditions, so it was decided to sink two shafts about 60 ft. apart. These two shafts were arranged to assist in the development of the ventilation system (actually they are both down-cast), and certain safety-first ideas, such as connections, fire-doors, and sprays, were included in the design. The hoisting equipment was to be a permanent feature, not changing with depth, and was designed for an ultimate depth of 5000 ft. The design called for a rope-speed of 3000 ft. per minute, so that about 160 tons per hour could be hoisted. The adoption of electricity as the motive power for the new hoists was decided upon only after all the factors of cost, reliability, and electric design had been considered. One of the determining factors was the amount of steam required by the milling process. The discussion of the relative merits of steam and electric hoisting is outside the scope of the present article. Suffice it to say that electric hoists have reached a stage of dependability unknown ten years ago, while the inter-connecting of the various ramifications of the Montana Power Co. guarantees a supply of power in which interruptions are extremely rare.

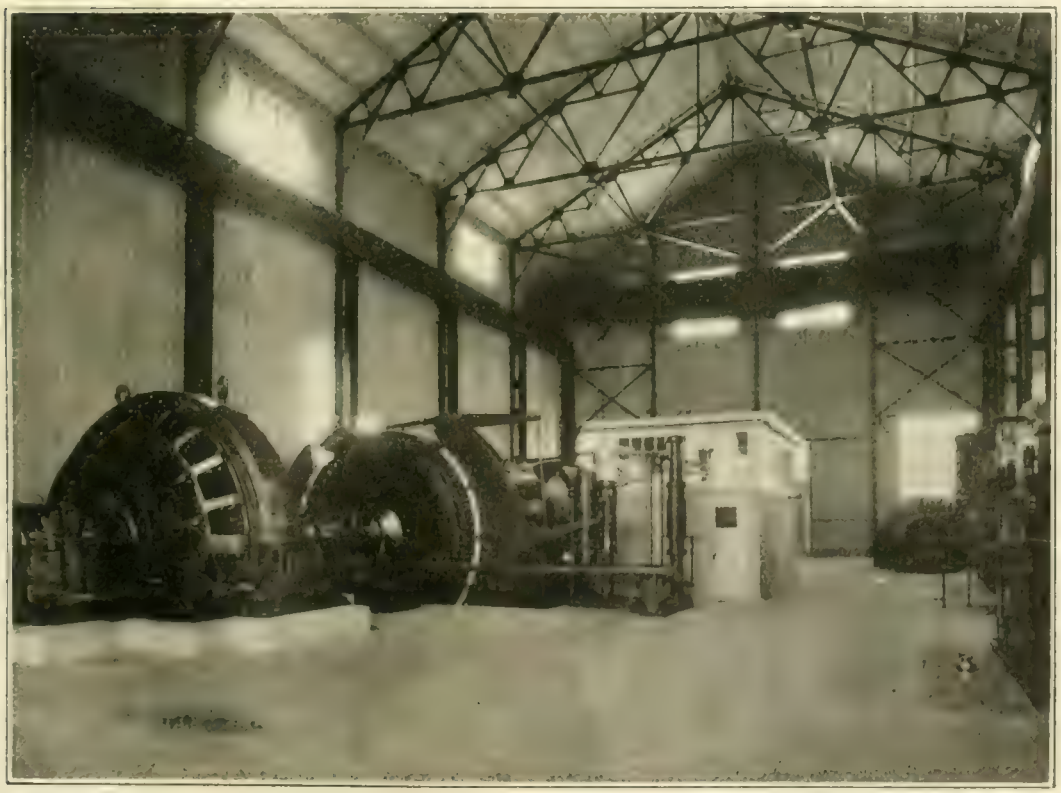
The main shaft has two skip-compartments and one small compartment for signals, etc. The 'chippy' shaft has three full compartments, two for skips and one for pipes and power-lines. The steel head-frame at the main shaft is 135 ft. from the ground to the centre of the sheaves, which are of 12 ft. diameter. The main hoist is set back 400 ft. from the head-frame, the ropes running over idlers on two steel towers placed between the shaft and the hoist house. For handling men, four superimposed cages are used in each compartment of the main shaft, and two cages in the chippy shaft-compartments, making 12 decks in all. This means 120 men lowered at each round trip of both hoists, an important factor when sending a shift of 600 men into the mine. The skip weighs 5 tons, and holds 7 tons of ore; the cage above it weighs 2.5 tons, making a total load of 14.5 tons. The rope is of 1.5 in. diameter and weighs 4 lb. per foot. The rope at the chippy hoist is of $1\frac{1}{8}$ in. diameter.

Both the Ilgner and Ward-Leonard systems are embodied in the hoisting equipment, but they are too well-known to call for more than brief mention here. The heavy fly-wheel on the motor-generator set is the main feature of the Ilgner system. When the load on the generator becomes heavy, as at starting, the set is slowed down by a regulator on the A.C. motor, causing the fly-wheel to give up some of its stored energy and put into the system power that would otherwise have to be drawn from the supply mains. Peak loads, and hence cost of power, are thus reduced. On the other hand, if the descending load in the shaft speeds up the hoist, the D.C. motor becomes a generator and puts power into the motor-generator set, thus speeding up the heavy fly-wheel. When the speed of the latter is 5% over synchronous, the induction motor also acts as a generator and feeds alternating current back into the power-lines. The Ward-Leonard system applies to the regulation of the hoist-speed by varying the field strength of the generator that supplies power to the hoist motor.

The diagram shows the arrangement of the main hoist as it will appear when complete. While not the largest electric hoist in the world, it will be the largest of the fly-wheel type. The photographs show the present condition of the equipment, in which the motor-generator set consists of one A.C. motor, one fly-wheel, and one D.C. generator with exciter; the hoist has one D.C. motor. When complete, a second fly-wheel and D.C. generator will be added to the motor-generator set, and a second D.C. motor to the hoist. These additions will be made as the shaft approaches its ultimate depth of 5000 ft. The main hoist and the chippy hoist are in separate rooms, each having its own overhead crane. This is a good arrangement, as it means that the lighter machinery of the chippy hoist can be handled by a small crane, leaving the big crane for the heavily constructed main hoist. The motor-generator set for the chippy hoist is in the same room as the main hoist.

The induction motor that drives this set is developing about 1400 hp. at present, but when the set is complete it

THE SHAFT-BUILDING OF THE BUTTE & SUPERIOR MINE, SHOWING HEAD-FRAMES, STEEL IDLER TOWERS, AND CHIPPY HOIST



ELECTRIC HOIST, SHOWING D. C. MOTOR, HOIST-DRUMS, OIL-PRESSURE RELEASE FOR BRAKE AND CLUTCH, ENGINEER'S CABIN, OVERHEAD CRANE, ACCUMULATOR AND SWITCHBOARD ON RIGHT AND M. G. SET FOR CHIPPY SHAFT IN THE CORNER.

will develop 2000 hp. To give the higher rating, an alteration will be made in the winding, the present series-delta being changed to a parallel-star. The speed is 500 r.p.m. and the voltage is 2200. A three-phase 60-cycle current is taken from the Montana Power Co. at the above voltage, two separate lines coming in from their main sub-station, about a mile from the mine, so that it can be arranged to run the hoisting eequipment on a line separate from that supplying the power for the mill. The induction motor has an automatic slip-regulator for inserting resistance into the rotor to reduce the speed. This regulator operates when the load comes on at starting and during the acceleration period, thus preventing a too heavy demand on the power-line. As the speed of the set is reduced, the fly-wheel gives up energy to take the peak load. The fly-wheel is a disc of 12 ft. diameter, built up of steel plates riveted together, its effective weight being 60 tons. At 500 r.p.m. it has a peripheral speed of 18,850 ft. per minute. It is mounted on a shaft of 18 in. diameter, which runs in two water-cooled bearings, each 4 ft. long, lubricated by both ring and gravity-feed systems. Besides these, oil at a pressure of 1500 lb. per square inch can be forced under the shaft for raising it off the bearings when it is desired to start the set after a stoppage. The fly-wheel is housed in order to reduce wind friction. The D.C. generator is a 1500-kw. shunt machine with interpole and commutator windings. Its field is controlled directly by the hoist-engineer, as will be explained later. The maximum voltage is 650. In case of shutting down the motor-generator set for any reason, there is provided a reverse-switch for putting a counter-torque on the motor, resulting in its coming to rest in about five minutes, as against 2½ hours if left to run free. The exciter for the set is a 60-kw. 250-volt shunt-machine, whose voltage is kept constant by a Terrill regulator. The exciter is for both motor field and generator field excitation, and for the control of all the safety-devices. In case of accident to this machine, a spare exciter (a motor-generator set) is provided. All these machines are rated at a continuous operating figure allowing for a 40°C. rise in temperature; they are all capable, as far as commutation is concerned, of taking a momentary over-load of 100%. The weight of the motor-generator set (including the fly-wheel) as in use at present is 285,000 lb. When complete it will weigh about 500,000 pounds.

The two drums on the hoist consist of cast-iron spiders with shells of rolled-steel plate. The present diameter is 9 ft., but this will be increased to 12 ft. for the complete equipment, when each drum will carry 5000 ft. of 1½-in. rope in two layers. The present speed of hoisting with the 9-ft. drums is 2260 ft. per minute. The capacity to 3000 ft. depth is 216 tons per hour, allowing for an acceleration period of 20 seconds and a retardation period of 15 seconds. The diameter of the shaft is 16 in., with the connecting flange forged solid. Lubrication of all bearings is by ring and gravity-feed systems. The maximum speed is 80 r.p.m. Brakes are applied by weight and released by oil-pressure, though there is not so much braking necessary with an electric as with a steam hoist, the speed of the former being reduced by moving the controller back, the brake being applied only for the final stoppage. Oil at a pressure of 100 lb. per square inch is supplied by triplex pumps (installed in duplicate), while an accumulator is provided on the line, which would give several operations of brake or clutch should the pumps go down. The D.C. motor is direct-connected to the drum-shaft. It has a continuous rating of 2000 hp. but is capable of a heavy over-load, as is demonstrated by the ammeter when starting, the current being between 4000 and 5000 amperes. The maximum voltage is 650. The weight of the hoist without the motor is 375,000 lb., the motor weighing 180,000 pounds.

The hoist-engineer sits in a closed cabin lighted by windows and ventilated by a fan. He has three levers in front of him, one being the master-controller, the others the brakes for the two drums. Two cranks for operating the clutches are placed one on each side of him. Engineers accustomed to hoisting by steam have no trouble in learning to operate an electric hoist; in fact, they prefer the latter once they have become familiar with it. The master-controller works a series of contactors on the switchboard, which cut resistance in or out of the generator-field to regulate the speed of the hoist. Since the field of the hoist-motor is separately excited, its speed will vary directly as the impressed voltage coming from the generator. The hoist will run at certain speeds, constant for each notch on the controller. The equipment is such that by pushing a button the speed is automatically reduced for hoisting men. This control is independent of the master-controller, but is seldom used. Welsch safety-devices prevent over-speed or over-winding; they operate by shutting off the power and applying the brakes. In addition, a limit-switch is being put into the shaft, which will be positive in its action. Should the indicator on the Welsch device slip, the over-wound cage will hit the limit-switch mounted on the head-frame. To ensure reduction of speed at the proper point, there is a cam slow-down device that pushes over the master-controller as the cage approaches the collar of the shaft. This device operates should the engineer not slow down, and will ensure the hoist being at a low enough speed for its prompt stoppage if the cage should open the limit-switch. Power (if on) is cut off, and brakes are applied if power from the generator to the hoist-motor fails for any reason; if power for control, or for the motor-field, is lost; if the motor-generator set over-speeds owing to power coming back into the circuit. In case any safety-device functions, the controller must be brought back to the central position before brakes can be released. All safety-devices work on the closed-circuit principle, so that if a wire breaks, or the current goes off the circuit for any reason, the safety-devices operate and the hoist stops. All these automatic safety-contrivances have been tested in actual work, so that every confidence is felt in their reliability; besides which every effort has been made to eliminate all possible mishaps, such as are usually classified at an inquest as "unforeseen". In case the power-lines coming to the

mine go dead, there is sufficient energy in the fly-wheel to make several trips in the shaft with men. If the motor-generator set goes out of action altogether, of course, no hoisting can be done, the case being comparable to the complete failure of the boiler-plant at a steam-hoist.

The 'chippy' hoist may be regarded as a small edition of the main hoist, with one or two minor changes. The drum is 8 ft. in diameter by 9 ft. long, and makes 68 r.p.m., being geared to the motor-shaft by Wuest herring-bone gears. The motor on this hoist is rated at 600 hp. with a voltage of 500 and a speed of 450 r.p.m. There is

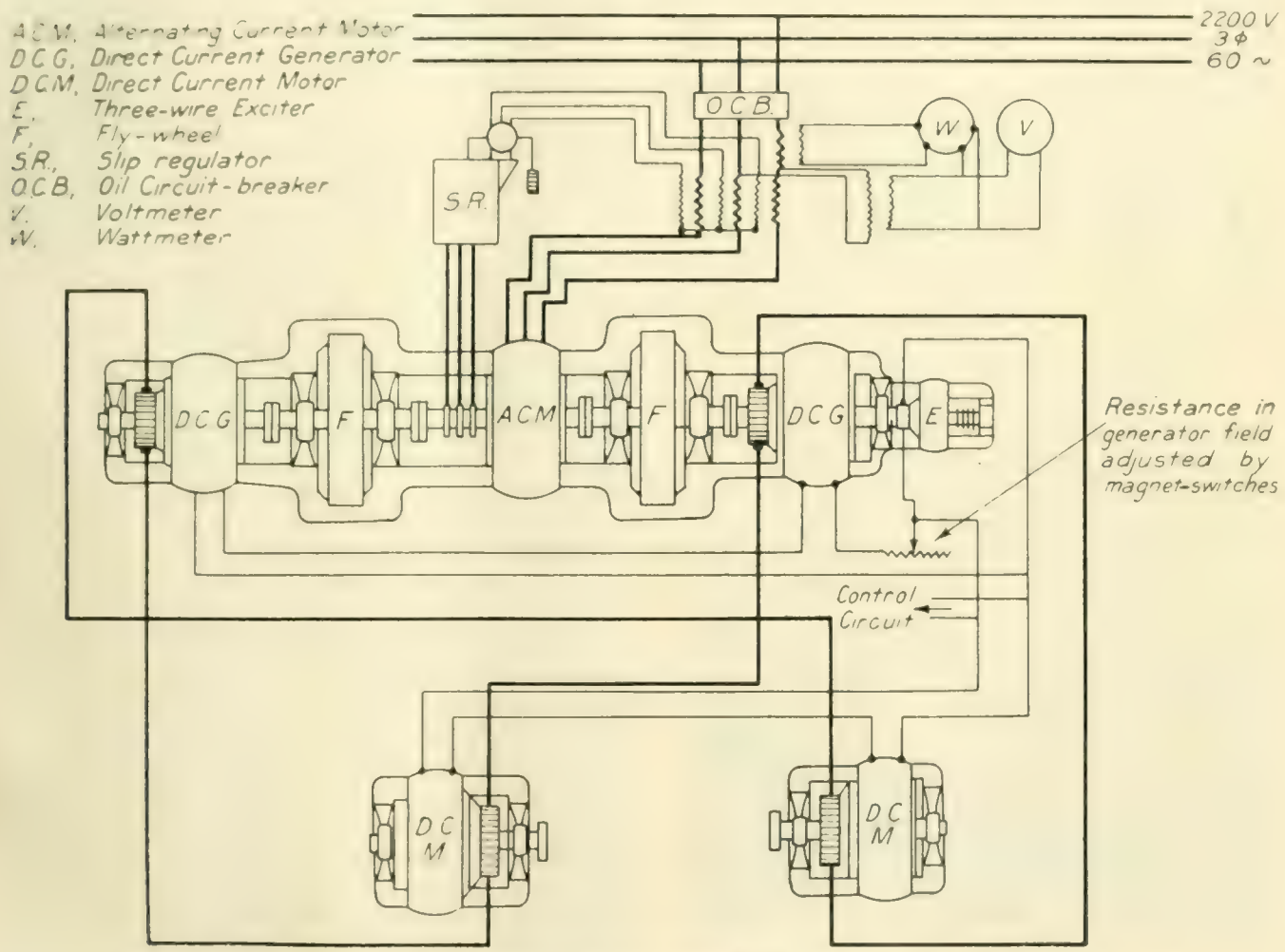


DIAGRAM OF CONNECTIONS WHEN OPERATING FROM 5000 FT. AT 3000 FT. PER MIN. SPEED OF ROPE

a flexible coupling between the motor-shaft and the shaft carrying the gear. The rope speed is 1660 ft. per minute. All the safety-devices found on the main hoist are installed on the chippy. For speed-control a face-plate controller is used instead of the contactors of the larger machine. The motor-generator set consists of an A.C. motor of 600 hp. making 720 r.p.m., a fly-wheel weighing 20 tons (to be increased to 40 tons when the depth is 5000 ft.), a shunt-wound generator of 500 kw., and a 7½-kw. exciter.

All windings on hoist-motors and generators are insulated with mica to take care of high temperatures. The hoists were made by Nordberg, and the electrical equipment by Westinghouse. All electrical machinery is in charge of R. E. Renz, chief electrician, whose assistance in the preparation of this article I wish to acknowledge.

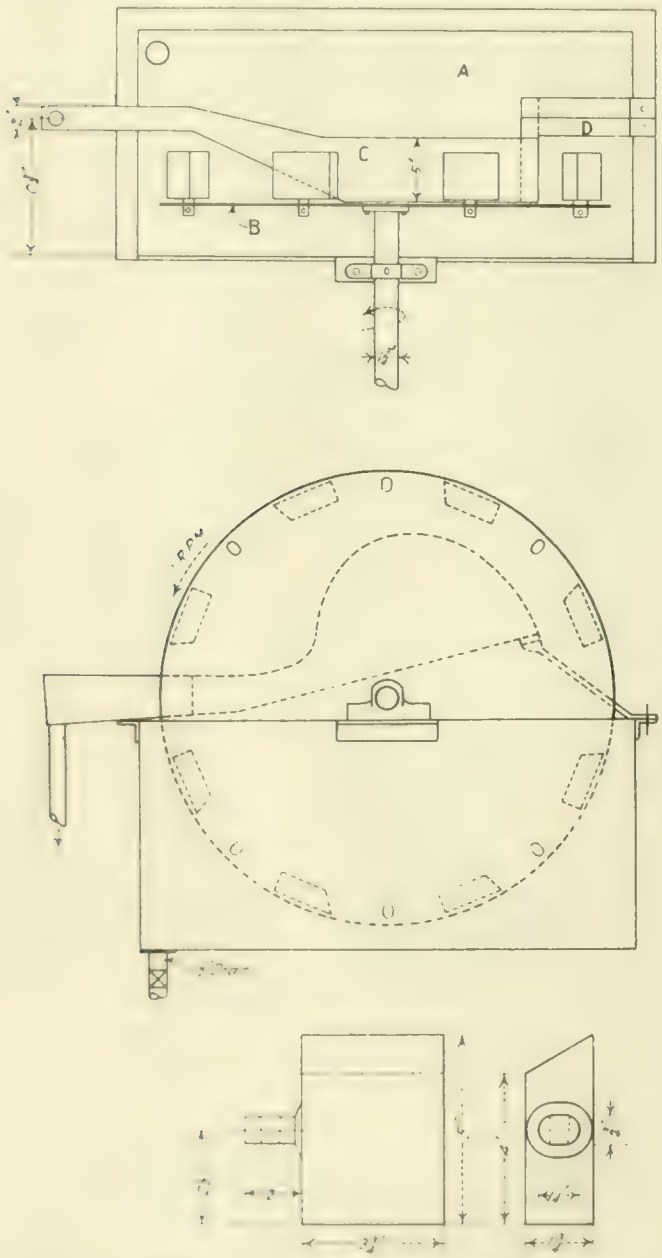
TIN PRODUCTION of the Federated Malay States during 1918, according to the Chamber of Mines, amounted to 37,370 long tons, a decrease of 2463 tons. The exported ore or oxide averages 72% metal. The product is smelted at Penang and Singapore. The pre-war rate for reduction was 70 cents per picul of 133⅓ lb., but the present charge is $1.47. The average price last year was $85.30 per picul, an increase of $23.72 in 1917. Since the close of the year it has been necessary, owing to the absence of any market for tin, for the Government of the Federated Malay States to become a buyer at $67 per picul, the price paid by the Government being subsequently reduced to $56.78 per picul. The mining community contributed toward the revenue of the country in royalty alone $7,462,062, which is 13.90% of the gross value of the ore recovered. This shows the substantial increase of $2,097,840, or 39%, over the revenue derived from tin during 1917.—Consular Report.

THE OROVILLE DREDGING CO.'S boats in Colombia, South America, recovered $28,950 from 28,767 cu. yd. at Pato, from April 10 to 28.

A Feeder for Oil or Acid in a Flotation Plant

STAFF CORRESPONDENCE

The feeder herein described is employed in the concentrator of the Anaconda reduction works. Some mention of this appliance has already appeared in print, but the present article goes more into detail in describing the feeder actually in use today.*



To each section of the concentrator there are two of these feeders, one for acid and one for oil. They supply the acid and oil for treatment, per 24 hours, of about 6000 tons of pulp, equivalent to about 1200 tons of dry material consisting of ground Wilfley-table middlings. To this is generally added some thickened slime, making the total pulp about 6780 tons. This pulp is elevated for distribution to three standard Minerals Separation machines, with 15 cells and 14 spitzkasten each, and it is into the discharge of this elevator that the acid and oil are fed, thus obviating any corrosive action on the belt or buckets of the elevator. The feeders are placed side by side, and discharge into a lead pipe serving both, thus mixing the acid and oil on their way to join the pulp. Both liquids are sufficiently viscous to give a practically continuous thin stream.

The principal parts of the feeder are a box *A*, to hold the acid or oil; a bronze disc *B*, to carry the buckets; and a trough *C*, into which the buckets discharge. The box *A* is made of light steel plate, and lined with lead $\frac{1}{8}$-in. thick. The inside dimensions of the box are: length 3 ft. 3 in.; width 1 ft. 6 in.; depth 1 ft. 4 in. A non-corrosive oil would, of course, not require a lead lining, and a steel disc could be used instead of one of bronze. The box is stiffened at the top by a light angle running around three sides. On the fourth side, it has a piece of angle to carry the bearing. Acid or oil is fed periodically into the box to maintain a sufficient level of liquid to fill the buckets. The bronze disc *B* is 3 ft. in diameter by $\frac{1}{4}$ in. thick. It is bolted to a flange on the shaft, and has the lead buckets attached tangentially to it. The details of the buckets are shown in the sketch. They are of 3/32 in. sheet-lead, and have at one side a block of oval section to pass through an oval hole in the disc. The buckets are attached to the disc by driving a tapered pin through a $\frac{1}{2}$-in. hole in the oval block. Should this hole become enlarged, a bolt with a washer may be used instead of the pin, the washer jamming against the disc. The capacity of each bucket is 330 cubic centimetres.

As the disc revolves, the buckets dip into the liquid contained in the box, elevate it and discharge it into the trough *C*, which empties into the pipe running to the discharge of the pulp-elevator. As originally designed, the speed of the disc could be varied by means of a friction-drive; but at present the drive is made directly by a bevel gear on the shaft, and the disc revolves at a constant speed of about one revolution per minute. To vary the feed, buckets are added or removed from the disc, plenty of holes being provided for this purpose. The trough *C* is of lead $\frac{1}{8}$ in. thick, and is of such form that the buckets can discharge into it and afterward pass clear of it. The wide end of the trough is supported by a lead bracket *D*, bolted to the edge of the box. The box-lining, trough, and buckets are all made up by the lead burners.

*Frederick Laist and Albert E. Wiggin. 'Flotation Concentration at Anaconda'. Trans. A. I. M. E., Vol. LV.

DREDGING at the Lenskoie property of the Lena Goldfields company in Siberia has been postponed on account of the revolution in Russia. The first dredge was ordered in America over three years ago, is fully paid for, and awaits shipment at South Milwaukee. Reserves of gravel for dredging are estimated at 58,984,000 cu. yd., averaging 39 cents per yard recoverable. This is sufficient for two 17-cu. ft. boats for 16 years, according to C. W. Purington. In November 1917 there were 5379 men employed at the mines, who averaged only 0.14 cu. yd. of gravel per man-day.

REVIEW OF MINING

HOUGHTON, MICHIGAN

MORE UNDERGROUND WORK MAKES DEMAND FOR MINERS.

The demand for labor in the Copper Country has taken a sudden change, men are scarce, and there is work for every man here. All mines could use a few more men underground than they have at present. Sixty days ago the mines were laying off men and reducing production 50%. A total of 2500 men were discharged or quit; the majority were surface employees. Miners were not generally let out. Today there is not a mine in the district that could not use more trammers and miners. That does not portend an increase in output of ore, nor yet an increase in copper production; it simply means that shortage of cash is not the prime consideration with the mines. Rather was the action taken to prevent a too long continuance of an over-stocked metal market. The miners are at work in newer openings. Every operating company in this district is making the most of this opportunity to get its mine in good physical condition.

GOLD HILL, OREGON

STATE BUREAU OF MINES RESUMES INVESTIGATIONS.

The director of the Oregon Bureau of Mines, Henry M. Parks, has announced that the Bureau expects to do considerable field work in southern Oregon during the present season. The auto-truck engineer crew of the Bureau left Portland on June 3 for this region, and will be operating during the coming few weeks in the Jacksonville district south of Gold Hill. This outfit is an auto-truck upon which is mounted a complete sampling, crushing, pulverizing, and assaying plant. The power is operated by the motor of the truck. There will be four or five men in the crew, and they will make detail examination of a number of partly developed mines, most of which are now idle. Mr. Parks expects to be there during the preliminary work.

During the War, the State Bureau suspended all field operations, likewise its publications, but with an appropriation of $50,000 by the recent Legislature, the Bureau will resume field work throughout the State and publish results. There will be also a systematic investigation of oil and gas possibilities. The field work in eastern Oregon is being done jointly with the U. S. Geological Survey, while the western part of the State is being investigated solely by the State department. The Bureau has contracted with a well known firm of consulting oil geologists to do the work in western Oregon.

The War Minerals Relief Commission will probably hold a public meeting at Medford early in August to hear any further evidence in support of the claims filed for relief in southern Oregon and northern California.

The lessee of the Nellie Wright gold mine, R. M. Wilson, three miles east of Gold Hill, who recently undertook to unwater the mine preparatory to resuming operations, found that the present electric power-line and service were not sufficient to operate the mine and mill. The property is less than ¼ mile from the main transmission-line passing down the valley on the Pacific highway, but due to the lapse of this service during the 24-hour period, he will be forced to put in an independent wire to the sub-station at Gold Ray, a distance of 5 miles, at an expense of $1500.

KESWICK, CALIFORNIA

OPERATIONS OF THE MOUNTAIN COPPER CO. DURING 1918.

The Mountain Copper Co. has issued its report for 1918. The profit from the sale of metals, acid, etc., was £88,159 ($420,000). After charging £48,606 ($230,000) for depreciation, £6722 ($32,000) for American taxes, and £43,750 ($206,000) for debenture interest, there

CONCENTRATOR OF MOUNTAIN COPPER CO., SHASTA COUNTY, CALIFORNIA

was a deficit of £7626 ($36,000). Ores, metals, and stores on hand are valued at £155,674 ($744,000); cash, £81,132 ($380,000); investments, £162,021 ($770,000); and sundry debtors £42,654 ($201,000). Sundry creditors are owed £67,566 ($320,000). The 6% debentures amount to £625,000 ($3,000,000).

The consulting engineers, Burch, Caetani, and Hershey, reported as follows:

At Iron Mountain, developments in No. 8 mine were uniformly successful, resulting in an increase of reserves and average grade. The West vein contains 157,561 tons of 2.49% ore, plus 88,000 tons probable. Little exploration was done in the Complex mine, in which re-

serves are 93,596 tons of 2.22% ore, plus 33,500 tons probable. Miscellaneous ore in these mines is 17,700 tons of 2.22% ore. The Hornet mine is estimated to contain 1,320,000 tons. The New Year mine opened better than expected. Further drilling is to be done to find another 'layer' of ore; and later on, work may be done jointly with the Balaklala company.

The railway is in good physical condition. It is suggested that an aerial tram be constructed to take its place. The railway cannot be abandoned entirely for three reasons: (1) it is doubtful whether the Old Mine filling can be carried in buckets, it being uneven in size and sticky; (2) flotation concentrate is too sticky for buckets; and (3) the long timbers for the mine can hardly be carried by a tram. However, an aerial tram would reduce costs generally.

The Minnesota mill's capacity was proved to be 500 tons per day, instead of 550 as planned; but slight changes will remedy this. In order to produce a 15% copper concentrate, a tailing loss of 10% is expected. The new plant to treat Old Mine filling was completed at the end of the year. Preliminary tests showed good results.

At the smelter at Martinez, costs rose to a point somewhat above those of the period that preceded the change in mining and smelting methods. Abnormal conditions were the cause. The leaching plant worked well. It was to be enlarged to treat a larger quantity of calcined material from the Hornet mine. There was treated during last year 6023 tons from the Iron Mountain mine, 20,491 from No. 8, 27,418 from the Hornet, 16,001 of concentrates, and 8782 from other mines. The output of copper was 3448 long tons, or 7,723,520 pounds.

LEAD, SOUTH DAKOTA

GENERAL DEVELOPMENT AND MILLING NOTES.

Custer.—The Summit property near Oreville has been sold to John R. Bland, and men are getting it in shape for production. The copper ore can be graded easily by hand-sorting, and this will be done until such a time as the development warrants erection of machinery. It is expected that shipments to the smelter will be made regularly.

Deadwood.—Good progress is being made at the tunnel which is being driven to open the old workings of the Iron Hill mine in the Carbonate district. The tunnel has gained a depth of over 500 ft., and when completed will have a length of 1350 ft. Aside from draining and making these workings accessible, it will pass through virgin ground that in all probability will show mineral. The Iron Hill was the richest silver mine in the Black Hills, but has only been developed to a depth of 400 ft. The present work is being done by Eastern capital that holds options on the property and adjacent ground.

The Deadwood Lead & Zinc Co. has completed all arrangements for placing in commission its 10-stamp concentrator in Spruce gulch. A delay in the delivery of suitable motors caused an idleness of several months. The new equipment is expected shortly and the plant will be in operation before July 1. The mine has been developed to a point where a continuous output of ore is assured.

The Cutting Mining Co., whose property adjoins the Homestake on the west, is continuing development. A shaft is being sunk, and has gained a depth of 250 ft. This will be continued to 500 ft., to be followed by extensive lateral work. A new single-drum hoist and Ingersoll-Rand compressor have been installed. Electric power is used. A good grade of gold-silver ore was opened in the upper workings, and this is being developed with depth.

Englewood.—The Custer Peake Copper Co. has completed erection and started a concentrator. Wilfley tables and Bland screens are used. The Jungle mine, which is being worked by the company, shows copper ore on several levels, and is said to contain 4% native copper. The ore will be dressed and shipped to the smelter.

Hill City.—The National Tin Co., formerly the American Tin Co., has resumed work at the Cowboy and Mohawk mines. Ore is being broken in the former, and the latter is being developed. It is proposed to sink the Cowboy shaft, now 300 ft. deep, to 500 ft. A new 550-ft. Norwalk compound compressor has been added to the mine equipment. Additions are being made to the concentrator, and seven Wilfley and eight Isbel slime-tables have been purchased. In addition to this, a ball-mill for re-grinding has also been added. Alexander Roy of New York has been placed in charge as general manager.

Lead.—Sinking of the Ellison shaft of the Homestake company has been started. At present this shaft is down 2090 ft., including a sump 90 ft. It is proposed to sink several hundred feet and cut stations every 150 ft., then open the levels. The storage for 10,000 tons of coal has been completed. An Erie ¾-yd. clam-shell bucket-shovel is used in loading the coal into cars from the open bin, for distribution.

Trojan.—The Dark Horse and General Grant properties have been leased to Manion, Harris, and Stewart and regular shipments of ore are being made to the Trojan cyanide plant.

DIVIDE, NEVADA

DEVELOPMENTS AND PROPOSED WORK BROUGHT DOWN TO DATE.

Ore production from the Tonopah Divide mine continues at the rate of 60 tons daily, mill-heads ranging from $30 to $35 per ton. This ore, shipped to the MacNamara mill at Tonopah, is drawn from all parts of the mine; from the four main levels and connecting raises. On the second level the south-east foot-wall drift is being advanced in good ore. It was the shortest of the south-east drifts, having advanced 160 ft. from the shaft cross-cut. The third level south-east drift was resumed lately from a point 350 ft. from the shaft cross-cut and is in ore of shipping grade. Two raises from the fourth to the third level were recently holed through. The first raise, 50 ft. from the shaft cross-cut, broke ore throughout averaging $60 per ton; the second, 250 ft. from the

cross-cut, was in high-grade ore all the way, the product for over 30 ft. near the top averaging $285 per ton. The fourth level drift to the south-east, resumed after the new compressor was started, has been breaking ore of high grade, having entered the rich shoot in which a sill 30 by 50 ft. was opened on the third level. This drift has exposed large masses of quartz, the first found in quantity in the mine. The presence of quartz does not affect the value of the ore. Two cross-cuts were started from the fourth level drift, which is on the hanging-wall side of the ore-channel, but neither exposed the foot-wall at a distance of 30 ft. from the drift. Both cross-cuts continued in rich ore. The consulting engineer, A. I. D'Arcy, says that the fourth level has proved far richer than levels above, and declares that the uniformly high value of ore throughout the large area developed, rather than bonanza spots and sensational assays, establishes the great value of the mine. The fifth level cross-cut is being driven to the vein, at a depth of 581 ft., and at the present rate of progress, about 7 ft. daily, should penetrate the hanging wall before the end of June.

Seams of rich ore were exposed in surface prospecting some time ago on the Divide Extension property, 600 ft. north of the main shaft. An assessment hole had been dug at this point by 'Jimmy' Grimes, a pioneer prospector and claim-owner of the district, who had abandoned this ground. A shot in the bottom of this hole exposed ore stringers and Ed. J. Bevis, the superintendent, after obtaining the consent of Zeb Kendall, president and manager, proceeded to sink a prospect shaft here, using a windlass. Rich seams were found in the course of sinking, and at a depth of 45 ft. laterals were started north-west and south-east. These were designed for drifts, but as work progressed it was shown that they were cross-cutting a wide fracture-zone, with a trend that has since been agreed upon as N.22°E. Well-defined walls were found 55 ft. apart, with a south-east dip, and drifts have been advanced north-east on both walls. Both have continued in high-grade ore, the foot-wall drift having exposed faces continuously sampling from $150 to $320 per ton, and the hanging-wall drifts ranging from $50 to $150 per ton. The ore between these drifts is said to average over $25 per ton and the waste-dump, taken from the shaft and cross-cuts, is of shipping grade. This shaft is being timbered and hoisting equipment will be working shortly. Surface trenching has exposed the vein farther north and near the Dividend side-line, where high assays are obtained from these trenches. The main shaft is 400 ft. deep, and a drift will be driven, following the north-west vein, to reach the north vein.

On the Dividend property, trenching has exposed the Extension vein near the joint boundary, where this vein is intersected by another with a strike nearly east. At the point of junction the latter vein is said to swing to the north, uniting with the Extension vein and forming a large fractured area that appears to be enriched to a high degree. At one point, assays ranging from $50 to $150 were obtained across 12 ft. of this material. The ore throughout this zone is said to contain argentite and stephanite, and good authorities express the belief that its source is at considerable depth. The Dividend main shaft, 1500 ft. north-west from this point, is down 500 ft., where a station is being cut. On the 300-ft. level a cross-cut has been driven within an estimated distance of 50 ft. from the north-west vein. This cross-cut will be continued to the vein, while another will be extended in the same direction on the 500-ft. level. George J. Murphy is superintendent. Control of the Dividend company is said to have been purchased by men controlling the Divide Extension, including Herbert G. Humphrey of Reno, one of the largest wool-growers in the country; Zeb Kendall, George Wingfield, and John H. Miller. These men control the largest enterprises at Divide.

At a depth of 180 ft., the shaft of the Divide Consolidated is in the typical ore-bearing material of the district —a silicified highly-oxidized rhyolite-breccia—and for the last 15 ft. box-samples have ranged from $9 to $48 per ton. The property has one of the best plants in the district, and the shaft is making rapid progress. Throughout the Divide district the ground breaks and stands well; little or no timber is required and a 6-ft. round in lateral work is not unusual.

In the East Divide workings, the south drift is advancing 12 ft. daily with two shifts. The east cross-cut on the 400-ft. level penetrated the foot-wall of a vein 93 ft. from the shaft. This vein is 26 ft. wide, the entire mass averaging $7 per ton. The south foot-wall drift has progressed over 100 ft. in similar material, and is showing seams of rich sulphide. It is being driven to reach the point where this vein intersects the main east fissure, below the great blow-out east of the shaft.

The Florence Divide company recently purchased the Witt-Brandon-Taylor-Mechling lease on part of the Red King claim of the Florence Goldfield property, and ore as rich as any ever taken from the bonanza leases on that property is being sacked for shipment. The richest, assaying $5 per pound, is stored in bank vaults. The second-grade ore assays from $500 to $1500 per ton and the miners have ready 200 sacks of this material, while the third-class product, worth from $75 to $200 per ton, will be shipped without sacking or sorting. At one point the richest of this ore is nearly 2 ft. wide. It is broken with great care, by stripping the bonanza streak.

On the Brougher Divide, efforts are being made by trenching to locate the Extension vein.

The Gold Zone is extending cross-cuts north-east and south-west on the 500-ft. level, having found only narrow seams of ore in exploring the main fissure-zone.

The Tonopah Hasbrouck is shipping ore at the rate of 50 tons per week to the MacNamara mill at Tonopah, and is blocking a substantial tonnage in work conducted from the lower tunnel, and in re-opening the old workings from a cross-cut at the 200-ft. level of the main shaft.

The Sutherland Divide is developing on the 300 and

400-ft. levels from the incline shaft, and has started to sink another 200 ft. Seams of rich ore have been found on the 300-ft. level. This shaft produced ore for shipment some 15 years ago, the ground being owned early in 1901 by the South Tonopah Mining Co., the first company after the Tonopah Mining to be incorporated in the Tonopah region.

Among properties now well equipped and sinking are the Victory, Belcher, Mohawk, Consolidated, Smuggler, Gold Wedge, Eureka, Farrell, Kernick, Reno, Belcher Extension, High Divide, Annex, Horseshoe, Mammoth, Ben Hur, Operator, Gold Reef, Alto, Allied, Crown, Bevis, Mecca, Western, Junior, Hull City, Liberty, Calumet, Trilby, Rosetta, Divide City, Florence, East Divide Extension, Mizpah, Aztec, Argentine, Apex, Giant, Hercules, Anchor, Chariot, Syndicate, Grimes, Emancipator, Hasbrouck Divide, Hennessy, Jim's, Myra, North, Northwest, Old Timer, Pershing, Rand, Revert, Silver King, Toggery, Verdi, West, Wilson, and Argonne Divide. Several of these have exposed highly mineralized fracture-zones, similar to those in which pay-ore has been found. Surface prospecting is being conducted on a number of properties, with the object of finding the best sites for sinking.

GRASS VALLEY, CALIFORNIA

STRIKE MATTERS.—LITIGATION OVER TOWNSITE PATENT.

Events connected with the strike during the past week are chronicled as follows:

A number of men have left the district for Nevada centres. These were principally single men, who in most mining centres move about a good deal.

The deputy State Labor Commissioner, John S. Blair, has been endeavoring to effect a settlement. Suggestions from both sides were exchanged. A compromise proposed by the operators on June 24 was rejected by the men, who are holding out for the extra 50 cents a day without any concessions. The proposal was:

"First: We will abolish the bonus system.

Second: We will establish a free market at no cost to the purchaser or seller. This will eliminate the middleman and his profits. The free market will be able to supply goods to the consumer at the lowest cost, overcoming expensive book-keeping, delivery, and service costs. The free market will handle boots, dry goods, meats, groceries, and in fact, goods of every description.

Third: We ask that hereafter should any grievance arise that these be taken up with the management and discussed fully, and in a proper manner before any drastic action is taken.

Fourth: We propose a percentage wage increase along the lines suggested by some members of your committee, as follows: At the end of a year from date we will pay 10% of the total wages earned by every man who has worked for us continuously throughout the year.

Fifth: As a proof of our sincere desire to aid you we will pay on next pay-day one-half of the wages lost by our employees, provided that you return to your former work promptly after the settlement of this matter."

In the M. & S. P. of June 21, it was stated that the North Star Mines Co. was to pay a dividend of 40 cents per share on June 28. The Grass Valley 'Union' of the 24th contained the following:

A. B. Foote, superintendent of the North Star mine, gave out the following signed statement yesterday concerning the dividend of 40 cents per share stated by the 'Mining and Scientific Press' as about to be paid by the North Star Mines Company:

The article appearing in the 'Mining and Scientific Press', referring to the dividend declared by the North Star Mines Co., is misleading, and in the light of certain statements made by the management, requires explanation. The dividend declared a year ago was paid out of the reserve fund, and the one declared payable the 28th of this month is to be paid out of the same fund. Neither of them could have been paid out of the profits of the past year, since there was no profit.

The company has kept a large reserve fund to carry it over periods like the present, and also because it carries no insurance. Some of the stockholders are dependent upon the income from their stock, and to help them it is necessary to distribute some of this reserve fund.

ARTHUR B. FOOTE,
Superintendent.

During 1918, the North Star company made an operating profit of $57,668, but after allowing for depletion and depreciation, on the same basis as in previous years, the past year ended with a deficit of $221,735. The balance at the end of 1918 was $950,648.

On the 25th the men organized with a full complement of officers. J. B. Bennetts was elected president and Fred Osborne recording secretary. About 1000 signed the roll. Future meetings are to be in secret. The special committee of 12 heretofore selected is to be retained as a standing committee to resume negotiations at any time.

The strike came to a close soon after midnight on June 29 when the men voted unanimously to accept the compromise proposal of the operators.

The compromise provides for a wage increase of 10%, the sum to be paid as a bonus at the end of the year, the interest of workers of shorter periods than a year to be safeguarded. The men are to receive half-pay for the time lost during the strike.

A decision of much interest to mining men has recently been rendered by the Secretary of the Interior in the matter of the application of Golden Center of Grass Valley Mining Co. for a patent for a lode mining claim situated within the City of Grass Valley, Nevada county, California:

The company, on October 2, 1917, filed in the United States Land Office at Sacramento, an application for its lode claim situated in Grass Valley, claiming same under a lode location made in the year 1878 or 1879. The legal subdivision of land upon which the claim was situated appeared to be patented without any reservations, to the Trustees of the City of Grass Valley, under the townsite law upon a final entry made of said land by the townsite authorities under date of June 18, 1869.

The company filed with its application for patent, an application for a hearing, asking that it be allowed to prove that the land it claimed as a lode claim was at the

date of the townsite entry a known mine, or that it was at that time being held as a mining claim which possession was recognized by local authority.

The local Land Office at Sacramento refused the applicant company a hearing. This was based on the ground that the records of the Department of the Interior disclosed the fact that when the authorities of the townsite of Grass Valley were seeking to make the townsite entry, a hearing was ordered and heard before the local officers at Sacramento, as to the character of the land applied for by the townsite authorities. Based on evidence taken at this hearing, the Commissioner of the Land Office by a decision rendered on July 3, 1871, held that the land applied for by the townsite authorities was more valuable for agricultural and townsite purposes than for minerals. This decision was followed by a patent to the townsite authorities of the legal subdivision covering the mining claim of the applicant company, and the decision and patent barred the applicant company from asserting further claim to the lode claim for which patent application was made.

The Golden Center company appealed from the decision of the local office to the Commissioner of the General Land Office, who affirmed the decision of the local officers holding the townsite patent to be conclusive against the mineral claimant. The mineral claimant appealed to the Secretary of the Interior, who, in a decision recently handed down, reversed that of the local officers and the Commissioner, and holding that the decision of July 3, 1871, was not binding on the Golden Center or Grass Valley Co., and that it was entitled to a hearing as asked for.

In this decision, the Secretary states that the evidence in the case before the Commissioner taken at the hearing had, prior to July 3, 1871, disclosed the fact that evidence as to the character of the actual land now claimed by the Golden Center company was adduced, but held, nevertheless, that the decision was not binding upon the applicant company. The Secretary defined the law thus: the Department, in order to acquire jurisdiction to determine the question as to whether or not a known mine, or known mining possession, existed at date of townsite entry, must have a mineral application for land within the townsite pending accompanied by an application for a hearing to determine the question as to whether there was a known mine, or known mining possession, in existence at the date of the townsite entry. In accordance with the said decision of the Secretary in said case, the local office ordered a hearing for the purpose of permitting the Golden Center company to introduce evidence for the purpose of showing whether or not the mine claimed by it in the said townsite of Grass Valley was a known mine or known mining possession on June 18, 1869, the date of said townsite entry.

This hearing was recently heard, the City of Grass Valley, appearing in opposition thereto, and the case will probably be determined by the local officers at Sacramento in the near future.

So far as your correspondent knows this is the first case of its kind to be taken into the Land Department, affecting a townsite patent in central California; all others have gone the way of the local courts. A. R. Tabor of Sacramento is the first attorney to follow the procedure described above and a successful termination in his favor will result in considerable townsite litigation.

ANYOX, BRITISH COLUMBIA

DOLLY VARDEN DISPUTE ENDED.—GRANBY STARTS ITS BY-PRODUCT COKE-OVENS.

The Taylor Mining Co. has been incorporated with a capital of $1,500,000, and has taken over the Dolly Varden mine, at Alice Arm, thus ending a legal squabble that has moored this valuable property for a considerable period. Briefly, the dispute was between the Dolly Varden Mines Co. and the Taylor Engineering Co., the latter having constructed a railway along the Kilsault river to connect the mines with tide-water at Alice Arm, which the mining company was unable to pay for. After a protracted fight, fraught with legal technicalities, the two companies placed the matter in the hands of a legislative committee, which gave the Dolly Varden company 10 days in which to pay off the wage claims, amounting to $134,600, and 30 days, after a full accounting had been taken, to pay off the engineering company's debt of $462,500. In the event of failure on the part of the mining company, the committee gave the engineering company leave to pay the wages and take over the property, paying $200,000 in floating charges and indemnifying the shareholders of the mining company out of profits from the mine. The Dolly Varden company admitted the Taylor company's claim, but defaulted on payment, so the Taylor Mining Co., a subsidiary of the Taylor Engineering Co., was formed, and has paid the wage claim and taken over the property. It is gratifying to notice that the staff of the new company, which already has proceeded to the mine, is composed mainly of returned soldier-miners. [Their names are given in the personals of the 'Press' of July 5.]

The Granby Consolidated company started its new by-product coke ovens at Anyox during the visit of the president, W. H. Nichols, who has just returned from the property. The ovens were designed during the War with the view to saving, among other by-products, toluene and benzol for munitions, and it is claimed they are the only ovens of the kind on the Pacific Coast. The tar will not be treated at Anyox, but will be shipped to Vancouver, where re-distillation products will be saved and manufactured. Coal is being supplied to the ovens from the Granby company's newly-developed areas at Cassidy siding, near Nanaimo. Owing to the strike at Crow's Nest Pass, the Granby company's Grand Forks smelter is nearly out of coke, and it is feared may have to close. Considering the longshoremen's strike, it is doubtful if the Anyox ovens will be able to save the situation. The Vancouver authorities seem to have the strike well in hand; while it is causing inconvenience, it is not causing any serious hardship.

THE MINING SUMMARY

Black blasting powder is now quoted in California as follows from June 24:

Carload lots (minimum 800 kegs), $1.70 per keg; 100-keg lots, $2; 10-keg lots, $2.10; and under, $2.25 per keg. This is a general reduction of 20 cents per keg.

In Technical Paper 223 of the U. S. Bureau of Mines, just issued, mine-owners will find a good deal of interest in 'Cost Keeping for Small Metal Mines', by J. C. Pickering. Included in the 43 pages are specimen charts and tabulated reports, these and the methods being modifications of practice at mines with which the writer has been connected. Accounting is not discussed, as it is not within the scope of the discussion.

ALASKA

The Alaskan Engineering Commission has reported to Congress that the Government railroad will be completed in 1921, at a total cost of $50,436,971, or about $73,200 per mile. L. J. McPherson, engineer in charge, said that this cost compared favorably with American continental construction costs. It is proposed to employ between 5000 and 6000 men this summer.

The President has signed a proclamation by which 307,800 acres of land are eliminated from the Chugach national forest. The land consists of two separate tracts, one known as the Ship Creek area near Anchorage, containing about 109,300 acres; the other is a strip of national forest land three miles wide between the Fox and Kasilof rivers, amounting to 198,500 acres. Much of the eliminated land is reported by the Forest Service examiners to have agricultural possibilities. This is the second large elimination from Alaskan national forests made as a result of the land classification work done by the Forest Service. In 1915, the Chugach forest was reduced by nearly 6,000,000 acres. The present elimination brings the forest down to approximately 5,500,000 acres, with a stand of between 7 and 8 billion board feet of timber, much of which is valuable for airplane stock and paper-pulp.

ARIZONA

Clifton.—The Arizona Copper Co. has purchased the entire holdings of the Shannon Copper Co. The latter's holdings in the Clifton district approximated 1000 acres of mining land, together with a smelter and concentrator. A number of the claims of the Shannon company were contiguous to the Arizona property, and part of that now acquired was sold to the Shannon company by the Arizona company a few years ago. Extensive tests are being carried out at No. 6 concentrator at Clifton on the low-grade ores of the Shannon. This work is meeting with success. The Shannon smelter is to be scrapped.

Jerome.—At a recent meeting of directors of the Verde Squaw Copper Co. it was decided to resume operations. It is believed that the first operations will be confined to drilling.

Tucson.—The War Minerals Relief Commission has completed three days of interviewing claimants. Arizona's [illegible] and Tungsten. The Commission, during its stay here, made its headquarters at the office of the Arizona State Bureau of Mines, University of Arizona.

COLORADO

Breckenridge.—The three dredges of the Tonopah Placers Co., one of the Powder River Gold Dredging Co., and one of the French Gulch Dredging Co., are digging a total of 16,000 cu. yd. of gravel daily.

Denver.—The new Commissioner of Mines, H. F. Lunt, with James Duce, oil inspector, and James Dalrymple, coal mine inspector, have gone to the 'western slope' to inspect the State's oil-shale beds and report on the probable cost of developing the local industry. The data collected will be published in a bulletin to be issued by the Bureau of Mines. Besides obtaining information regarding the commercial possibilities of the shale, the Commission will make a study of the safest and most efficient methods for mining it. At the same time as this investigation, three field parties, under direction of R. D. George, State Geologist, are to make an oil and shale survey. These parties will be in charge of the assistant geologist, R. C. Coffin, and Mr. George.

The fifteenth biennial report of the State Bureau of Mines for 1917 and 1918, in charge of Fred Carroll, commissioner recently resigned, has been issued. The book contains 206 pages, covering all matters pertaining to mining in Colorado. The four district inspectors are T. R. Henahen for Denver, M. J. McCarthy for Cripple Creek, R. J. Murray for Leadville, and Robert Innes for Durango. J. T. Duce is chief clerk at Boulder. The Bureau costs $34,800 per annum. The accident record for 1917 was 56 killed and 713 seriously injured, and for 1918, 47 and 628, respectively; in 1916 the figures were 69 and 742. The principal events in the various districts are briefly discussed, while the rarer ores are given a fair amount of space. Some new maps would have improved the different reports. Arthur J. Hoskin covers oil-shale; and C. W. Henderson, of the U. S. Geological Survey, the 42 pages of statistics. Since 1858, Colorado has produced metals valued at $1,405,484,255, gold accounting for 44%, silver 34%, lead 12%, copper 2.5%, and zinc 7.5%.

In the case of the City Bank & Trust Co. (closed), its cashier (R. A. Brown), and the president of the Colorado Pitchblende Co. (J. S. Barnhill), the cashier surrendered on June 26. He said that he had been to Rico. He was charged with grand larceny of a check for $20,000, pleaded not guilty, and was released on a $1000 bond. The bank's books show a shortage of $140,000. There is nothing to report regarding affairs at Boulder.

Gateway.—Paradox Valley shows increasing activity as the season progresses. A shortage of miners still handicaps operations. The weather is favorable for good roads. A survey is now under way for a road from Gateway to the valley, opening an outlet to Grand Junction, and making a short route to the East, over a standard-gauge line, with lower freight rates. There is no doubt but that the road will be built, as interests along the route are making a strong petition for it. As an example of the great transportation expense borne by local operators, the Radium Luminous Material Co.'s problem is typical: The workings are 58 miles from the Rio Grande Southern railroad, a narrow-gauge line; 3½ days are required for a trip with 6-horse teams. Upon delivery at rail there is a haul of several miles

over narrow-gauge lines to Alamosa, where there is a transfer to the standard-gauge road. The ore is shipped to the reduction plant of the company at Orange, New Jersey. Some of the ores of this part are sent out by way of Ridgway and Montrose; but in either event there is a transfer from narrow to standard-gauge.

The Standard Chemical Co. has leased part of a local coal mine to furnish its reduction plant with a regular and cheaper supply. A cut-off on the road to the workings will shorten the round-trip haul by 15 miles.

The Colorado Vanadium Co. is planning the construction of a large mill at Fall creek to treat the output from its extensive holdings at Bear creek, and along the San Miguel. The company has leased the Summers mill at Sawpit and will remodel to treat vanadium ore temporarily.

Leadville.—The Mt. Champion gold mine is to resume operations at an early date.

The Bohn and Northern mines continue to produce manganese, but their contracts expire soon, yet it is expected that they will be renewed.

Rico.—There is said to be a shortage of miners in this district. A clearing-house has been decided upon, and a bulletin board at the 'Item' office will contain the names of the companies wanting men.

Silverton.—The Sunnyside M. & M. Co. has decided to commence building operations immediately. The boarding and bunk-houses will be at Midway, at the upper workings, and are to provide accommodations for 150 men. The new structures will be of steel and corrugated iron construction. A new compressor plant will also be built. During the next four months, the principal operations will be sinking the Washington shaft to the Terry tunnel, a distance of 600 ft. Milling operations are to be resumed in the near future.

Telluride.—Production from this district is not heavy, as many men are engaged on development, and getting out ore for shipment at a later date. A shortage of miners continues, notwithstanding the fact that the wage-scale is high.

All production from the Black Bear property of the Smuggler Union has ceased, and men are sinking the main shaft to a depth of 800 ft., preliminary to opening larger areas of stoping ground.

The Smuggler Union is enlarging all boarding and bunk-houses in anticipation of a greatly increased force of men. A new structure will be an apartment house to accommodate families.

The Old Smuggler mill is now under lease to a company that is working over the mill waste. As there is an accumulation of 25 years, and as there is reported to be good value in this product, it is probable that the leasees will make a good profit.

The Tomboy Gold Mines Co. reports satisfactory progress at the new flotation plant.

IDAHO

Kellogg.—The Bunker Hill & Sullivan company's sawmill and immense stock of lumber here have been burned. Although in danger for a while, the new concentrating plant was not damaged. The loss was estimated at $200,000.

Kellogg.—The formation of a mining company which expects to spend about $40,000 in development near here within the next few weeks, is announced by E. O. Conner, one of the incorporators. The organization will be known as the Great Dunker Mining & Milling Company.

Wallace.—Black Bear has had a change in directorate. Work, suspended since 1915, will be resumed. A good deal of lead-silver-zinc ore is said to be available.

KANSAS

Baxter Springs.—Production of this field last week was 1776 tons of blende and 136 tons of lead, valued at $82,730. The output is well maintained.

MISSOURI

Joplin.—Many miners in the Tri-State zinc-lead region have gone to harvest crops, and will be away a month or more, leaving the mines short of men. The stock of blende on hand is estimated at between 15,000 and 25,000 tons. Production is 8000 tons per week and sales about 11,000 tons.

MONTANA

Butte.—The East Butte smelter expects to receive 400 tons of ore daily from the Colorado mine of the Davis-Daly company, when work is resumed there. Davis-Daly at present is shipping 100 tons daily.

Butte & Superior is soon to start deepening its No. 2 shaft from the 2050-ft. level.

Anaconda pays $1 per share, equal to $2,331,250, on August 25.

The safety departments of mining companies in this district held a big field day on July 4, similar to that of last year. The first-aid demonstration was the feature of the day. The program also included drilling contests, running, boxing, two brass bands, and free refreshments to all persons. John L. Boardman was chairman of the arrangements committee.

Helena.—On June 21 another meeting was held here to complete organization of the Montana Mining Association, which aims to promote development of the mining industry of the State. Membership of the committee is: on membership, Sam D. Goza, Helena; publicity, Charles D. Greenfield, Helena; finance, George L. Ramsey, Helena; smelting and ore dressing, Charles E. Fryberger, Helena; labor, Senator Page of Granite county; legislative, W. J. McCormick, Missoula; Government bulletins and geological surveys, L. S. Ropes, Helena; transportation and roads, Paul Pratt of Lincoln county; and grievances, Alexander Leggat of Butte.

NEVADA

Rochester.—The Nonpareil Mining Co. has been formed to operate the Nonpareil claims on the west side of Lincoln hill. L. T. McAtee of San Francisco, is president, and M. Helliere of Reno is secretary. The ground adjoins the Lincoln Hill group, and has produced $30,000 in gold.

Tonopah.—Some of the yields for May were as follows: Belmont—8916 tons for 100,051 oz. of silver and 1036 oz. of gold, with $56,407 profit. Extension—8866 tons for 108,876 oz. of silver and 1019 oz. of gold, with $56,458 profit.

On July 4 there was held here a jack-hammer drilling contest, also competitions between shovelers.

OKLAHOMA

Picher.—Production of this district last week was 4858 tons of blende and 854 tons of lead, valued at $257,276. The Picher mines yielded 1100 tons of blende and the Bilharz 501 tons.

TEXAS

Terlingua.—The Louisiana-Texas Quicksilver Co., composed of Louisiana people, has acquired 8960 acres of land in this district. Development will begin at an early date, partly by core-drilling. A 100-ton retorting plant is proposed. E. A. Waldron of El Paso put through the deal.

UTAH

Bingham.—The Montana-Bingham resumed operations on June 1, after a shut-down of four months. Lessees during this period shipped some high-grade lead and copper ore.

Eureka.—The East Tintic district is busy. There are 15 new shafts being sunk, and an equal number contemplated. The Copper Leaf is down 1200 ft. J. W. Taylor is in charge. —The Iron King has just put in an electric hoist for its 1200-ft. shaft. N. W. Roberts is superintendent.—The Big

Hill group of the Jesse Knight interests are being prepared for development in charge of H. W. Trenholm.

Tintic.—The Eureka Bullion company, managed by J. M. Bestheneyer, has opened rich ore on its 800-ft. level. At a point 630 ft. in, 2 ft. of 8-oz. silver and 4% lead ore was cut. A cross-cut was then driven 80 ft. back from the face, finding 4 ft. of ore assaying from 9 to 20% lead, 23 to 71 oz. silver, and $2 to $2.40 gold per ton. Carbonates and sulphides have practically united at this depth. In other mines of this district, these ores are found in different zones.

WASHINGTON

Leadpoint.—The Electric Point Mining Co. is to erect a power-plant, and has let a contract for excavating.

Loon Lake.—The Loon Lake Copper Co.'s new 75-ton concentrating plant is in operation, in charge of W. L. Ziegler, who has installed flotation machines of his own design. Included in the expenditure of $50,000 is a 6-drill compressor, 50-hp. engine for hoist, 200-hp. engine in the mill, two 4 by 4-ft. ball-mills, two drag classifiers, thickener, two 5-cell flotation machines, and a 4-ft. filter. Dump ore, carrying 2.5% copper and ½ oz. of silver, has given a 92% recovery. Ore-reserves are estimated by C. J. Stone at 28,000 [illegible]

Republic.—The Lone Pine-Surprise has opened the ore-body at 650 ft. depth for a length of 50 ft. It averages 6 ft. across, of good value in gold. Shipments are made to the smelter at Tacoma. C. P. Robbins is manager.

CANADA

British Columbia

Britannia.—The Howe Sound Co. pays 5 cents per share on July 15. This amounts to $99,207.

Hedley.—The Hedley Gold Mining Co. paid 10 cents per share on June 30. This is equal to $12,000, making $24,000 for 1919 and $2,436,000 to date.

Sandon.—The tramway for the Wonderful mine, near this place, is complete. It is about a half-mile long, and has one span of over 1000 ft. without a tower, one of the longest spans of the Ainsworth-Slocan district.

Construction of an aerial tram from the Sovereign mine to Sandon is in progress, the work being in charge of Irwin White. The Sovereign is one of the Cunningham properties, and its ore will be treated at the Alamo concentrator. It is reported that the Alamo mill is almost ready for operation. Completion of the pockets and the elevating plant for the handling of ores from the Sovereign and Wonderful mines will put the concentrator in shape for work.

Trail.—Consolidated Mining & Smelting paid a dividend of 2½% on July 2. This is No. 33, the regular quarterly, and is equal to $261,936, and makes $785,808 for 1919.

Ontario

Cobalt.—Nipissing vein 109 has been one of the most important developments in this field for a long time. For 130 ft. the shoot was 2 in. wide, averaging 3000 oz. of silver per ton. In a circular, dated May 24, the company stated that it had acquired on favorable terms an important interest in approximately 1000 acres of undeveloped land about four miles south of the Petrolia oil and gas field, 20 miles south-east of the Burkburnett oil-pool, and almost due north of the Ranger oilfield of Texas. As soon as possible, and probably within 30 days, the drilling of a well will be started. The results of the operation will be given shareholders without delay.

Kirkland Lake.—Mine managers and the Union were to meet here on the 19th to discuss the strike. The Lake Shore, Tough-Oakes, Wright-Hargraves, Teck-Hughes, Elliott-Kirkland, Kirkland Lake Gold, and others are all closed. The meeting between mine-owners and workers on June 21 was fruitless.

Porcupine.—The Hollinger paid a dividend of 1%, $246,000, on June 17. This is the third for the current year, and makes $10,162,000 to date.

MEXICO

Business men who recently participated in a trade excursion into Mexico [from San Antonio, Texas] are not inclined to favor the immediate investment of capital in that country. Banking facilities were found to be unsound; transportation was suffering severely from the lack of rolling stock; and manufacturing, smelting, and mining industries were operating on part time. A visit was made to Tampico, where the oilfields were shown to be unsettled. The excursionists were everywhere given a courteous and cordial reception. Crops seemed to be good, and it was reported to members of the party that they were better than they had been for several years past. These statements are taken from a report made to the National Association for the Protection of American Rights in Mexico (head office in New York), by a member of this trade excursion who writes that "the conditions in Mexico are still far from normal, but sufficient improvement has been noted during the last few months to warrant an effort toward establishing more active commercial relations. The majority of the excursionists, however, are not inclined to favor the immediate investment of capital in Mexico. They believe a better plan is to cultivate closer social relations with the Mexicans, study their needs and customs, and lay the foundation for the business which they feel certain will come from Mexico."

Baja California

Santa Rosalia.—The Boleo Copper Co., controlled in France, has curtailed its mining and smelting operations on account of the copper market. It recently laid off several hundred of its 3800 employees and closed some departments at the works. This company has carried on extensive operations in Lower California for many years. The mines are extensive. Being remote from the remainder of Mexico and the United States, little public information has been available. It is known, however, that there has been no interruption to operations during the years of revolution in Mexico and the war in Europe. The smelter output is shipped in the company's own vessels direct to France. Santa Rosalia has no railroad outlet. The town is practically owned by Boleo Copper Co., and is said to be modern and well kept. This company is noted for the high wages which it pays, the scale ranging from $2.50 to $9 per day, United States currency. At various times the different revolutionary factions tried to foment trouble among employees, but on account of the high wages and general contentment all efforts of this kind proved futile.

Hidalgo

Pachuca.—Santa Gertrudis, during the first quarter of 1919, treated 98,012 tons of ore, yielding bullion valued at $1,100,000, of which $345,000 was profit. The mill worked at 95.1% of capacity. Exploration covered 1854 ft., of which 665 ft. was in pay-ore. In the west end of the mine, parallel 1120, at 75 ft. above the 5th level, an ore-shoot has been opened for a length of 109 ft., averaging 2.47 dwt. gold and 23.2 oz. silver, for a width of 4.7 ft.; a raise put up at parallel 1128 to a height of 56 ft., averaged 3.93 dwt. gold and 31.6 oz. silver, for a width of 4.4 ft. At the mill the steel crusher-bin extension was partly erected; foundations for the mill-bin extension and for the Hardinge ball-mill were built. The vacuum filter-plant for clarifying solution was nearly completed. Four additional Dorr type agitating tanks were partly erected. Another Merrill slime filter was received and installed, making a total of eight presses, this completing this extension.

In El Bordo mine there was 2024 ft. of work done, 408

ft being in pay-ore. The more important results were:

Vein	Level	Length. ft	Width. ft	Average assay Gold. dwt	Silver. oz
No. 1	165	24.9	5.3	4.21	72.5
No. 1	165	9.8	6.9	1.64	17.8
No. 1	500	68.1	5.1	4.42	51.8
No. 1	500	47.9	6.0	3.54	44.4
No. 1	500	27.9	4.1	3.15	35.5
Mean		32.4	6.2	4.77	56.8

The first three are drifts, the others are raises.

Construction of the aerial tram to the Santa Gertrudis mill is progressing satisfactorily, and, depending upon deliveries of tramway equipment, shipments of which are coming forward fairly regularly, should be completed in August.

Jalisco

Hostotipaquillo.—The Amparo Mining & Milling Co. is

PART OF WESTERN MEXICO

treating 11,000 tons of ore per month in the cyanide plant. Apparatus is being installed to bring the capacity up to 15,000 tons. The Amparo has a better grade of silver ore on the lower levels than in the upper levels.

Cinco Minas is treating 17,000 tons of ore per month by cyanidation. They recently installed two No. 86 Marcy mills.

El Favor Mining Co. has rebuilt 15 of its stamps, and expects to have the entire mill in operation by August. The stamp-department was destroyed by fire by bandits in 1917. They are now treating 50 tons per day.

Espada Mines, located near El Favor, has its cyanide plant completed. Motors arrived in April, and they will soon be operating.

Sinaloa

Culiacan.—There is a great deal of activity in the Sinaloa region, due to the high price of silver. Most of the ores in this district are either lead-zinc-silver or copper-silver ores, although there is considerable copper-gold. Practically all of these ores are good for flotation.

Cia. Minera Jesus Maria y Anexas, of San Jose de Gracia, is running at half capacity on gold ore. Flotation of dump tailing and current plate tailing has proved to be successful, and the company is installing additional K & K machines to bring the flotation unit up to 100 tons per 24 hours.

PERSONAL

Note.—The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

Fred. Hellmann is at Los Angeles.

William W. Mein is at Lake Tahoe.

A. Chester Beatty has returned from London to New York.

L. S. Austin has gone to Salt Lake City, from Los Angeles.

Arthur Lakes, Major in the U. S. Army, left France on June 17.

Edgar Rickard has left Washington and become a resident of New York.

C. A. Beauchamp has gone to Lark, Utah, and will be away two weeks.

Oscar Lachmund is examining the United Copper mine, near Chewelah, Washington.

Welton J. Crook is examining mines in British Columbia. He will be away for a month.

J. T. Shimmin has been appointed manager of the Arizona Hercules Copper Co.'s milling plant at Hercules, Arizona.

Charles W. Stimpson, of Salt Lake City, attended the Bohemian jinks and proceeded from San Francisco to New York.

G. C. Evans, metallurgist with the Oriental Consolidated in Korea for nine years, has been on a vacation in Australia, and returned late in May.

P. B. McDonald, formerly on the editorial staff of the M. & S. P., has been appointed Assistant Professor of English in the School of Engineering in New York University.

Van H. Manning, Director of the U. S. Bureau of Mines, received the honorary degree of Doctor of Engineering from the University of Pittsburgh at the Commencement on June 21.

J. E. Spurr has resigned as Executive of War Minerals Investigations, Bureau of Mines, to take effect July 1. The War Minerals Investigations work will be terminated on that date.

Richard Hamilton, general manager of the Great Boulder Proprietary mine at Kalgoorlie, which has produced gold worth £11,171,490 and paid £5,466,175 in dividends, has been re-elected president of the Chamber of Mines of Western Australia for the 22nd consecutive year.

The new staff at the Dolly Varden silver mine, Alice Arm district, British Columbia, now operated by the Taylor Mining Co., is **Major D. E. Young**, from the Provincial Forestry Commission, general manager; **Major Angus W. Davis**, of the Consolidated Mining & Smelting Co. at Trail, mine superintendent; **R. B. McGinnis** of San Francisco, assistant; **H. B. Browning**, formerly office manager for the Canadian Collieries Limited, chief accountant and storekeeper.

The following distinguished mining engineers were in San Francisco last week on the occasion of a meeting of the Arizonan Chapter of the American Mining Congress: **Louis S. Cates**, manager for the Ray Consolidated Copper Co.; **Norman Carmichael**, manager for the Arizona Copper Co.; **W. B. Gohring**, superintendent of mines for the Calumet & Arizona Mining Co.; **George Kingdon**, superintendent for the United Verde Extension Mining Co.; **A. T. Thompson**, of the Phelps Dodge Corporation; **F. W. Maclennan**, manager for the Miami Copper Co.; **Julius Krutschmitt**, of the American Smelting & Refining Co.; **W. G. McBride**, of the Old Dominion Copper Co.; **J. A. Burgess**, manager for the United Eastern Mining Co.; **B. Britton Gottsberger**, of the Miami Copper Co.; and **L. O. Howard**, superintendent for the International Smelting Company.

THE METAL MARKET

METAL PRICES

San Francisco, July 1

Antimony, cast, cents per pound	50—60
Antimony, cents per pound	$8.50
Copper, electrolytic, cents per pound	19.25
Lead, pig, cents per pound	5.65—6.65
Platinum, pale, per ounce	$105
Platinum, 10% iridium, per ounce	$115
Quicksilver, per flask of 75 lb.	$95
Spelter, cents per pound	8.50
Zinc dust, cents per pound	9—12

Platinum held by the Government, amounting to 19,000 oz., is to be sold at $105 per ounce. It is said that this quantity is only about 10% of that held. Jewelers have been rather short of the metal lately.

EASTERN METAL MARKET

(By wire from New York)

July 1.—Copper is moderately active. Lead is quiet but firm. Spelter is quiet though steady.

SILVER

Below are given official or ticker quotations, in cents per ounce of silver 999 fine. From April 23, 1918, the United States government paid $1 per ounce for all silver purchased by it, fixing a maximum of $1.01½ on August 15, 1918, and will continue to pay $1 until the quantity specified under the Act is purchased, probably extending over several years. On May 5, 1919, all restrictions on the metal were removed, resulting in fluctuations. During the restricted period, the British government fixed the maximum price five times, the last being on March 25, 1919, on account of the low rate of sterling exchange, but removed all restrictions on May 10. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the normal rate of exchange.

Date	New York cents	London pence	Average week ending	Cents	Pence
June 25	110.12	54.31	May 20	110.33	53.56
" 26	109.50	53.75	" 27	106.44	52.17
" 27	108.75	53.25	June 3	108.90	52.90
" 28	108.50	53.12	" 10	109.43	53.27
" 29 Sunday			" 17	111.98	54.48
" 30	108.25	53.00	" 24	111.52	54.40
July 1	107.87	Holiday	July 1	108.83	53.48

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	75.14	88.72	101.12	July	78.92	99.62	....
Feb.	77.54	85.79	101.12	Aug.	85.40	100.31	....
Mch.	74.13	88.11	101.12	Sept.	100.73	101.12	....
Apr.	72.51	95.35	101.12	Oct.	87.38	101.12	....
May	74.61	99.50	107.23	Nov.	85.97	101.12	....
June	76.44	99.50	110.50	Dec.	85.97	101.12	....

The Finance Member of the India Council, when introducing the financial statement for 1919-20, made the following remarks regarding currency: "In April 1918 the position was stabilized by our purchase of American silver. The reserves from which we were subsequently to draw had been held at the rate of $1 per ounce, and that rate determined the price at which silver was sold to us, while our agreement with the United States government bound us not to buy any silver at a higher price while the Pittman Act remained in force."

Statistics relating to Indian trade, showing what proportion was transacted with the United States, are shown below (export figures include re-exports):

	American proportion, %	Average 1909-10–1913-'14	American proportion, %	1917-'18
Imports	3	£97,231,000	8	£100,283,000
Exports	7	149,411,000	13	161,704,000
Net excess of exports to India, and Treasure Sales in favor of India (about)		7,500,000		13,000,000

The total of £13,000,000 ($62,000,000) required by the United States for payment for goods purchased from India during 1917-'18, indicates one of the reasons why the former assisted the Indian government to provide [illegible] per annum.

The stock of silver in Shanghai consisted of about 30,400,000 oz. in sycee and 16,300,000 dollars on May 17.—Weekly (June 5) report of Samuel Montagu & Co., London.

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to [illegible] flasks of 75 pounds.

Date		Date	
June 3	95.00	June 17	95.00
" 10	92.00	" 24	95.00
		July 1	95.00

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	81.00	128.06	105.[illegible]	July	102.00	120.00	
Feb.	[illegible]	[illegible]	80.00	Aug.	115.00	120.00	
Mch.	[illegible]	[illegible]	72.80	Sept.	112.00	120.00	
Apr.	114.00	115.00	73.12	Oct.	102.00	120.00	
May	[illegible]	110.00	84.[illegible]	Nov.	102.50	120.00	
June	[illegible]	[illegible]	94.40	Dec.	117.42	115.00	

The New York [illegible] [illegible]

According to figures compiled by C. E. Siebenthal of the U. S. Geological Survey, [illegible] imported into the United States from January 1 to March 31 [illegible] from 23 producers [illegible] flasks of 76½ pounds, [illegible] flasks was [illegible] from [illegible] [illegible] Oregon [illegible] [illegible] [illegible]

Eastern Metal Market

New York, June 25.

The markets are all strong and firm but generally dull, except zinc. The price tendency in most of them is improved.

Antimony is quiet and unchanged.

Copper demand is light but quotations are nominally higher.

Lead demand is only moderate, but prices are firmer.

Tin market in the United State is now free, but prices for Straits have eased off.

Zinc is decidedly higher on heavy buying.

ALUMINUM

Virgin, 98 to 99% pure, is unchanged at 33c., New York, in wholesale lots for early delivery.

ANTIMONY

The market is quiet, with Asiatic grades obtainable at 8.25 to 8.50c., New York, duty paid, for wholesale lots for early delivery.

COPPER

The market is dull and not particularly active, but quotations are firm and higher, though nominal. This appears more or less paradoxical, but it is the real condition. Producers, large ones in particular, are expecting higher prices as a result of the signing of peace. These may not come at once, but already they are higher. Sellers are disinclined to sell ahead in view of the outlook and are firm in their ideas of values, even marking them up every day or two. The past week was rather quiet with quotations firm, but with the turn of the week they have advanced until today electrolytic copper is quoted and has been sold at 18.25., New York, for July delivery, with future positions nominally about ¼c. higher. Lake copper is strong and hard to obtain for July delivery; the nominal quotation is 18.50c., New York. The strikes in the brass territories have interfered some with demand, but the general tone of the market is optimistic and strong. One large producer states that there has been only one thing that has prevented the market from going to 25c., that being the large stocks which he thinks have been considerably reduced. An important factor as to the future is the belief that a resumption of full, or nearly full, producing capacity would now be impossible because of labor. This is another argument for higher prices as well as the looked-for export demand as a result of peace.

LEAD

The outside market is again back to that of the A. S. & R. Co., at 5.15c., St. Louis, or 5.40c., New York. The market is quiet but firm. A little business has been done, and all the cheaper lots have again probably been absorbed. Some sellers report the outside market at 5.45c., New York, with sales made and expect an early advance by the A. S. & R. Co. The better tone to copper and zinc has affected this market.

IRON AND STEEL

Orders are coming in faster than they are being completed and the consequent accumulative bookings is tangible evidence of the continued improvement. Recognition is being accorded the old law of supply and demand. Output of steel is now at about 60% of ingot capacity, and the probability is that the June output will be fully 10% more than that of May. British steel prices continue to advance; rails are now quoted there at $73.60 against $45 here, and wages have increased 12½% and mill operatives now demand the 6-hour day. Germany has already commenced taking steel orders in neutral countries under British prices—"at figures British makers cannot touch." Structural steel orders continue to grow, and the East is nearly abreast with the West in this line.

TIN

At last the tin market is an open one, so far as the territory of the United States is concerned. On Monday, June 23, George Armsby, chief in charge of tin, announced that all the allocated metal had been disposed of and that all restrictions on trading between consumers, dealers, jobbers, and smelters were immediately discontinued, and that licenses for the purchase of tin are no longer required. John Hughes, chairman of the sub-committee on tin, also announced on Monday that the American Iron and Steel Institute would continue to function until import restrictions were all removed, and also would act as an intermediary when desired as between those who have large stocks of tin to sell and those who desire to buy. The whole position is rapidly clearing up, and a world-wide open market may be in force very soon. Some insist that the actual signing of peace assures such a market, despite any attempt at control, and that tin stored in Canada may be imported from there. The actual market is quiet. There has been some buying for July shipment from the Straits at 51 to 52c., and import licenses have been granted for this. The inactivity has been a disappointment to the trade, however, in view of the better situation as to control. As to the market within the United States, Straits tin in consumers' hands has already sold as low as 70c., New York, which is now quoted as the market for spot delivery. That the high-priced metal should sell under the allocated price is not a surprise to some, who argue that consumers can afford to part with this metal at 70c. or less and buy tin for future shipment at 51 to 52c. and gain financially by the transaction. American pure tin is quoted on a parity with Straits at 70c., New York, and Banca for future shipment at about ½c. under Straits.

ORES

Manganese: Little business is heard of in high-grade ore. It is reported that about 40 carloads of low-grade ore, carrying 20 to 27% Mn, was recently sold to an Eastern steel company, the price involved not being revealed nor the use to which it is to be put.

Manganese-Iron Alloys: About 3000 tons of standard American ferro was sold during the past week at $110, delivered, but the quotation is again back to $125. It seems that one or two Philadelphia producers became frightened into the belief that British makers were about to take these orders, and so notified their American competitors of their lower prices and gathered in the orders. A change developed yesterday, and producers are generally again quoting $125, delivered, on the 600 or 800 tons now remaining before the market. There is an inquiry for 500 tons of spiegel, but the market is quiet at $28 to $30, furnace.

Molybdenum: Inquiry is reported as heavier, but it has not resulted in much business. Quotations are nominal at 75 to 85c. per pound of MoS_2 in regular concentrates.

Tungsten: The question of a tariff on ores has been a prominent topic recently, but nothing definite has materialized. The market is quiet and normal at prevailing prices of $7 to $10 per unit. There has been no testing of the ferro-tungsten market. Tungsten companies will find much of interest in the Hearings before the Committee on Ways and Means—House of Representatives—on H. R. 4437, a bill to provide revenue for the Government and to promote the production of tungsten ores and manufacture thereof in the United States.

Book Reviews

Mine and Quarry Tools. Simplified system of sharpening and tempering. By E. W. Liljegran. Pp. 16. Vest-pocket size. May be obtained by writing to the author at Medford, Oregon. Price, $1.

Some useful hints will be found in this little booklet, the result of experience at mines. The subject is important, as the quantity of ore and rock broken depends largely on the manner in which the steel has been treated in the blacksmith-shop.

Prospecting for Minerals. A practical handbook for prospectors, explorers, settlers, and all interested in the opening and development of new lands. Seventh edition. By S. Herbert Cox. Pp. 260, ill., index. Charles Griffin & Co., London, 1918. For sale by 'Mining and Scientific Press'. Price, $2.25.

To be candid about this little book, we might say that while it contains a good many practical suggestions, we do not agree with the preface to this last edition, wherein it is said that "revision does not appear to be necessary." On perusing the chapters covering chromite, sulphur, molybdenite, tungsten, antimony, and other minerals of much importance, we find that many of the great deposits are omitted, the tests are quite inadequate, and the uses of these products are not well explained at all. We are somewhat surprised that, considering the attention devoted to the non-ferrous and rarer minerals in recent years, the author and publishers did not look into this matter.

Mathematics for Engineers. Part I. By W. N. Rose. Pp. 474, ill., index. E. P. Dutton & Co., New York. For sale by 'Mining and Scientific Press'. Price, $5.

This volume, which is Part I, is devoted to elementary and higher algebra, mensuration and graphs, and plane trigonometry. Part II will consider calculus, harmonic and vector analysis, spherical trigonometry, and kindred subjects. The book is designed rather as a reference book for the practicing engineer, whether he be college-trained or self-educated, rather than as a text-book for the student, although it would also be of considerable value in supplementing the ordinary textbook. While mathematical theory is expounded carefully, the practical application of that theory is kept ever to the front with problems to be solved that are really practical, not like the old-style 'clock' problems that many of us remember. The chapter-headings are: Aids to Calculation, Equations, Mensuration, Graphs, Algebra, Plane Trigonometry, Areas of Irregular Curved Figures, Calculation of Earthwork Volumes, Platting of Difficult Equations, Determination of Laws, and The Construction of Charts. The text, unfortunately, contains a number of typographical errors, which should be corrected in another edition. However, these are relatively unimportant, and the book in general will be useful both to the practicing engineer and the student.

Excavation; Machinery, Methods, and Costs. By A. B. McDaniel. Pp. 526, ill. The McGraw-Hill Book Co., Inc., New York. For sale by 'Mining and Scientific Press'. Price, $3.

If it were not for excavating machinery, the 220,000,000 cu. yd. of material at the Panama Canal could not have been moved, nor could 35,000 tons of ore per day be moved from the Utah Copper Co. From the coolie shoveling earth into small baskets to the steam-shovel operator handling 6000 cu. yd. per day is a long step. The present volume is a revision and enlargement of the author's earlier volume on 'Excavating Machinery'. The same general arrangement is followed in the first part of the new book, each kind of apparatus being discussed in turn, but, whereas in the earlier volume the description of each class of equipment was followed by examples of its practical application, together with cost data, all this information, along with a good deal more of the same kind has been placed in Division II in the present volume. The chapter headings in Division I are as follows: Tools for Loosening and Hand Excavation; Drag and Wheel Scrapers; Blade or Road Graders; Elevating Graders; Capstan-Plows; Power-Shovels; Scraper, Templet, Trench, and Wheel Excavators; Cableways; Dipper-Dredges; Ladder-Dredges; Hydraulic Dredges; Subaqueous Rock-Drills; Car and Wagon Loaders. Division II, as already noted, is devoted to the practical application of excavating equipment including cost data. The arrangement here is according to the kind of work rather than the machine used for doing it, the chapter headings being: Highway Construction; Railroad Construction; Reclamation Work (including both irrigation and drainage); Rivers, Harbors, and Canals; Municipal Improvements; Quarries, Open-Cut Mines, Gravel-Pits, Brick-Yards; Tunnels and Underground Mines. A curious omission is that no mention is made of gold-dredges, although a large part of both divisions is devoted to dredges. The book is well-illustrated, mainly from manufacturer's catalogues. It will be of value to anyone engaged in excavating work.

Mining Decisions

Status of Association Placer Locations Prior to Discovery

A question arose in the course of locating association placer claims in California as to the effect of a conveyance by the association locators to one of their number or to a stranger. The Supreme Court of California in the case of Miller v. Chrisman, 142 Cal. 440, held that the associates might convey to one of their number without defeating the association location, and in the later case of Merced Oil Co. v. Patterson, 153 Cal. 624, it was held that the same principle applied to conveyances by the associates to a third party. In order that there might be no doubt on this subject, Congress passed an Act on March 2, 1911, 36 Statutes at Large, 1015, providing that patent might issue to an individual or a corporation for the full area of 160 acres where such a claim had been located under the mining laws as containing petroleum, oil, or gas, and where the original locators had transferred the same to a qualified person or corporation prior to discovery of oil or gas, provided that the location was in all other respects valid and was not withdrawn from mineral entry.

In the case of eight locators filing on 160 acres of land as a placer oil claim, who wish to convey the claim to a corporation to develop it, the corporation can hold the claim as a single claim of 160 acres, and does not need to cut it up into eight 20-acre tracts. The recent case of Union Oil Co. v. Smith, 39 Supreme Court Reporter, 308, a case decided (March 31, 1919) by the Supreme Court of the United States, is similar. The Court there points out the character of the title prior to discovery.

It should be remembered that the mistake of having 'dummies' act as locators before conveyances to a corporation should be avoided. Each of the original associates should be bona fide interested in the location and receive valuable consideration for the transfer to the corporation. A location by eight individuals for the benefit of a corporation, the individuals merely acting as dummies and not receiving valuable consideration, has been repeatedly held to render the location invalid, at least as to everything except 20 acres, which a corporation can lawfully locate in a single location.

Dividends From Mines, United States and Canada

UNITED STATES

Company and situation	Metal	Shares issued	Par value	Paid in 1919	Total	Latest dividend: Date	Amount
Adventure, Michigan	copper	200,000	$25.00	200,000	11,450,000	Mar. 31, 1919	1.00
Alloues, Michigan	copper	100,000	25.00	100,000	2,850,000	Mch. 31, 1919	1.00
American S. & R. U. S. and Mex.	c.l.g.s.z.	650,000 (com.)	100.00	6,500,000		Mch. 15, 1919	1.00
		600,000 (pfd.)	100.00				
American Z. L. & S., United States.	c.l.z.s.g.	96,500 (pfd.)	25.00			May 1, 1919	1.50
Anaconda, Montana	c.z.s.g.	2,331,250	50.00	10,490,825	156,848,125	Mar. 15, 1919	1.50
Argonaut, California	gold	200,000	5.00	60,000	1,950,000	Jan. 25, 1919	0.30
Atolia, California	tungsten	100,000	1.00		5,264,500	Sept. 15, 1918	0.50
Arizona, Arizona	copper	1,519,808	1.20		2,486,728	Mch. 31, 1918	
		3,515,430 7% pfd.			21,432,164	Aug. 21, 1918	0.36
Arizona Commercial, Arizona	c.g.s.	175,000	5.00		1,219,000	Oct. 31, 1918	0.50
Bonanza King, Montana	gold	400,000	5.00	80,000	340,000	May 15, 1919	0.10
Beaver Mines, Utah	l.s.g.	150,000	10.00	75,000	637,500	June 30, 1919	0.25
Bunker Hill & Sullivan, Idaho	l.s.	327,000	10.00	327,000	22,413,750	Mch. 4, 1919	0.25
Butte & Superior, Montana	c.s.	790,184	10.00		16,940,258	Sept. 1917	1.25
Butte Copper & Zinc, Montana	c.z.mn.	411,700	5.00		205,800	July 30, 1918	0.50
Caledonia, Idaho	l.s.	2,605,000	1.00	156,300	3,829,350	June 1, 1919	0.05
Calumet & Arizona, Arizona	copper	642,462	10.00	963,693	42,096,351	June 26, 1919	0.50
Calumet & Hecla, Michigan	copper	100,000	25.00		150,750,000	Dec. 31, 1918	15.00
Centennial, Michigan	copper	90,000	25.00		360,000	Dec. 31, 1918	1.00
Cerro Gordo, California	l.z.s.	975,000	1.00		299,375	Jan. 1917	0.05
Champion, Michigan	copper	100,000	25.00		23,374,540	Aug. 15, 1918	6.40
Chief Con., Utah	l.z.s.g.c.	884,223	1.00	158,003	1,402,873	May 1, 1919	0.05
Chino, New Mexico	copper	869,980	5.00	1,304,970	27,708,012	June 30, 1919	0.25
Consolidated Rexall, Utah	c.z.	586,434	1.00	14,600		Jan. 15, 1919	0.02½
Cons. Arizona Smelting, Arizona	c.z.s.	1,663,000	5.00		498,900	Dec. 1918	0.05
Con. Interstate-Callahan, Idaho	z.l.s.	464,990	10.00		7,091,098	Oct. 21, 1918	0.75
Copper Range, Michigan	copper	394,399	25.00	591,598	26,012,302	June 16, 1919	0.50
Cresson, Colorado	gold	1,220,000	1.00	732,000	7,881,163	June 10, 1919	0.10
Daly, Utah	l.s.g.	150,000	20.00	15,000	3,045,000	June 1, 1919	0.10
Davis-Daly, Montana	copper	600,000	10.00		450,000	Dec. 30, 1918	0.25
Dragon Con., Utah	c.l.s.g.	1,875,000	1.00		150,000	Oct. 1918	0.01
Ducktown, Tennessee	copper	198,000	4.80		2,678,702	May 1917	0.96
Eagle & Blue Bell, Utah	l.c.z.s.	893,146	1.00	44,657	1,205,747	Mch. 1919	0.05
East Butte, Montana	copper	411,000	10.00		1,462,828	Dec. 21, 1918	1.50
Electric Point, Washington	lead	793,500	1.00	23,790	277,575	April 1, 1919	0.03
Empire, Idaho	copper	1,000,000	1.00		880,000	July 1, 1918	0.05
Engels, California	copper	1,791,926	1.00		565,273	Oct. 1, 1918	0.01½
Federal M. & S., Idaho	l.z.s.	120,000	100.00	120,000	14,884,350	June 14, 1919	1.00
First National, California	copper	600,000	5.00	90,000	660,000	Mch. 1919	0.15
General Development, U. S.		120,000	25.00		4,913,917	Sept. 3, 1918	1.00
Golden Cycle, Colorado	gold	1,500,000	1.00	270,000	8,968,500	June 10, 1919	0.03
Grand Central, Utah	l.s.	500,000	1.00	20,000	1,822,000	April 21, 1919	0.03
Hecla, Idaho	l.s.	1,000,000	0.25	300,000	7,555,000	June 28, 1919	0.15
Homestake, South Dakota	gold	251,160	100.00	753,480	42,171,184	June 25, 1919	0.50
Inspiration, Arizona	copper	1,181,967	20.00	5,909,835	31,305,915	June 28, 1919	1.00
Iron Blossom, Utah	l.s.g.	1,000,000	0.10	25,000	3,200,000	Jan. 25, 1919	0.02½
Iron Cap, Arizona	copper	144,872	10.00		887,823	Dec. 1918	0.25
Isle Royale, Michigan	copper	150,000	25.00	75,000	1,950,000	Mch. 31, 1919	0.50
Jim Butler, Nevada	s.g.	1,718,021	1.00		1,151,074	Aug. 1918	0.07
Judge M. & S., Utah	l.z.c.s.g.	480,000	1.00	60,000	2,370,000	April 1, 1919	0.12½
Kennecott, Alaska	copper	2,786,679	5.00	2,786,678	45,143,675	June 30, 1919	0.50
Liberty Bell, Colorado	gold	133,560	5.00		2,594,181	Sept. 1918	0.05
Live Yankee Silver, Mexico	s.z.	715,337	10.00	214,601	5,201,955	Mch. 20, 1919	0.10
Magma, Arizona	copper	240,000	5.00	120,000	1,784,000	Jan. 6, 1919	0.50
Mass Con., Michigan	copper	100,000	25.00		486,585	Nov. 1917	1.00
Miami, Arizona	copper	747,114	5.00	1,120,771	20,715,715	May 15, 1919	0.50
Mohawk, Michigan	copper	100,000	25.00	300,000	8,925,000	Mch. 1919	1.00
Nevada Con., Nevada	copper	1,999,457	5.00	1,499,592	43,769,429	June 30, 1919	0.37½
Nevada Packard, Nevada	silver	1,164,592	1.00	23,292	110,643	April 20, 1919	0.02
Nevada Wonder, Nevada	s.g.	1,408,409	1.00	70,420	1,549,002	May 21, 1919	0.05
New Cornelia, Arizona	copper	1,404,900	5.00		351,225	Nov. 25, 1918	0.25
New Idria, California	quicksilver	100,000	5.00	25,000	2,705,000	Jan. 1, 1919	0.25
New Jersey Zinc, New Jersey	zinc	350,000	100.00	1,400,000		Feb. 10, 1919	4.00
North Butte, Montana	c.s.g.	430,000	15.00		14,657,000	Oct. 28, 1918	0.25
North Star, California	gold	250,000	10.00	100,000	5,537,040	June 28, 1919	0.40
Old Dominion, Arizona	c.s.g.	293,353	25.00		13,774,244	Sept. 30, 1918	1.00
Ontario Silver, Utah	s.l.	150,000	100.00	75,000	15,187,000	Jan. 4, 1919	0.50
Osceola, Michigan	copper	96,150	25.00	96,150	17,467,925	Mch. 31, 1919	1.00
Phelps Dodge, Ariz., N. Mex., Mex.	c.s.g.	450,000	100.00	1,125,000	81,221,527	April 2, 1919	2.50
Plymouth Con., California	gold	240,000	4.80	86,400	666,080	Jan. 1, 1919	0.12
Portland, Colorado	gold	3,000,000	1.00	120,000	11,377,080	April 21, 1919	0.02
Quincy, Michigan	copper	150,000	25.00	300,000	26,752,500	June 30, 1919	1.00
Ray Con., Arizona	copper	1,577,179	10.00	1,577,192	22,258,261	June 30, 1919	0.50
Rochester Mines, Nevada	s.g.	2,148,791	1.00		89,930	Oct. 1, 1918	0.02
Shannon, Arizona	copper	300,000	10.00		1,425,000	Nov. 15, 1917	0.25
Shattuck, Arizona	c.l.s.g.	350,000	10.00	525,000	7,610,500	June 25, 1919	0.15
Silver King Coalition, Utah	l.s.	1,250,000	5.00		15,198,560	Jan. 1918	0.15
Silver King Con., Utah	l.s.c.g.	700,000	1.00		1,562,705	April 1, 1918	0.10
St. Joe Lead, Missouri	lead	1,409,466	10.00		21,543,616	Dec. 20, 1918	0.50
Tamarack & Custer, Idaho	l.s.	1,776,500	1.00		461,830	Aug. 27, 1918	0.06
Tennessee Copper, Tennessee	copper and acid	391,498	no par value		392,817	May 15, 1918	1.00
Tintic Standard, Utah	l.s.	1,175,000	0.10	187,952	588,386	June 27, 1919	0.08
Tomboy, Colorado	g.s.	310,000	4.80		4,074,200	June 28, 1918	0.12
Tom Reed, Arizona	gold	909,555	1.00		2,620,000	Dec. 1918	0.02

Company and situation	Metal	Shares issued	Par value	Paid in 1919	Total	Latest dividends Date	Amount
Tonopah, Belmont Nevada	s.g.	1,500,000	1.00	300,000	10,018,063	July 1, 1919	0.10
Tonopah Extension Nevada	s.g.	1,282,801	1.00	192,420	2,104,819	May 16, 1919	0.10
Tonopah Mining Nevada	s.g.	1,000,000	1.00	150,000	14,675,000	April 21, 1919	0.15
United Eastern Arizona	gold	1,363,000	1.00	517,940	1,771,900	June 28, 1919	0.07
U. S. S. R. & M., U. S., Mexico	l z c s g	pfd. 486,350 com. 351,115	50.00 50.00	851,113 877,788	2,327,929 11,243,521	April 15, 1919 April 15, 1919	0.87½ 1.25
United Verde Copper, Arizona	copper	300,000	no par value	900,000	21,497,000	June 1, 1919	1.50
United Verde Extension, Arizona	copper	1,050,000	0.50	1,312,500	7,980,000	1919	0.50
Utah Apex Utah	c.l.s.g.	528,200	5.00		1,122,425	Nov. 1918	0.25
Utah Con., Utah	c.l.s.g.	300,000	5.00	75,000	12,810,000	Mch 25, 1919	0.25
Utah Copper Utah	copper	1,624,490	10.00	4,873,470	96,888,252	June 30 1919	1.50
Utah Metal, Utah	l.c.g.s.	691,588	1.00		895,734	Dec. 10, 1917	0.30
Vindicator Con., Colorado	gold	1,500,000	1.00	30,000	3,802,500	April 25, 1919	0.01
Wolverton Mines Colorado	l.z.	1,000,000	1.00	100,000	1,850,000	Jan. 1919	0.10
West End Nevada	s.g.	1,788,486	5.00	89,424	1,162,516	Feb. 18, 1919	0.05
Wolverine Michigan	copper	60,000	25.00	120,000	10,190,000	July 1, 1919	0.50
Yellow Pine Nevada	z.l.	1,000,000	1.00		2,310,000	Dec. 16, 1918	0.12
Yukon Gold, Alaska, Cal., Nev.	gold	3,500,000	5.00		9,858,110	June 1918	0.02½
CANADA							
Belmont Surf Inlet, British Columbia	g.c.	2,500,000	1.00	125,000	125,000	April 1919	0.05
Buffalo, Ontario	silver	1,000,000	1.00		3,287,000	Aug. 10, 1918	0.25
Cobalt Ontario	silver	800,000	5.00	200,000	9,440,600	May 1, 1919	0.12½
Con. M. & S., British Columbia	l c z s g.	419,098	25.00	785,808	6,041,848	July 2, 1919	0.62½
Florence, British Columbia	l.s.z.	1,100,000	1.00	17,650	35,300	April 20, 1919	0.01½
Granby Con. M. S. & P. B. C.	c.g.s.	150,004	100.00	562,467	10,339,352	May 1, 1919	1.25
Hedley, British Columbia	gold	120,000	10.00	24,000	2,436,000	June 30, 1919	0.10
Hollinger Ontario	gold	4,920,000	5.00	738,000	10,162,000	June 17, 1919	0.05
Howe Sound, British Columbia	copper	1,984,150	1.00	297,621	494,035	July 15, 1919	0.05
International Nickel, Ontario	n.c.	com. 1,673,384 pfd. 89,126	25.00 100.00	267,378	52,276,984 7,219,092	Dec. 1918 May 1, 1919	1.00 1.50
Kerr Lake, Ontario	silver	600,000	5.00	300,000	8,310,000	June 16, 1919	0.25
Lake Shore, Ontario	gold	2,000,000	1.00	50,000	150,000	Mch. 31, 1919	0.02½
McKinley Darragh, Ontario	silver	2,247,692	1.00	202,284	5,551,879	June 7, 1919	0.03
McIntyre, Ontario	gold	3,610,283	1.00	180,514	1,263,599	April 15, 1919	0.05
Mining Corp., Ontario	silver	1,660,050	5.00	207,455	6,113,000	Mch. 31, 1919	0.02½
Nipissing, Ontario	silver	1,200,000	5.00	1,200,000	20,340,000	June 21, 1919	0.50
Rambler-Cariboo, British Columbia	l.z.s.	1,750,000	1.00	17,500	560,000	Feb. 15, 1919	0.01
Standard, British Columbia	l.z.s.	2,000,000	1.00		2,700,000	Oct. 15, 1917	0.05
Temiskaming, Ontario	silver	2,500,000	1.00		2,125,000	Jan. 18, 1918	0.03
Tough-Oakes, Ontario	gold	531,500	5.00		398,625	Jan. 15, 1917	0.12½
Trethewey, Ontario	silver	1,000,000	1.00	50,000	1,211,999	Jan. 2, 1919	0.05

Abbreviations: g = gold, s = silver, c = copper, l = lead, z = zinc.

Note: Companies not included in the above list are requested to submit details. Changes in capitalization and new dividends will be entered on receipt of the information. This table will be published quarterly. Corrections are invited.

Company Reports

ST. JOSEPH LEAD CO.

This company has made application to the New York Stock Exchange for the listing of its capital stock, and its official statement contained some interesting data. The authorized capital is 2,000,000 shares, $10 par, of which 1,409,466 have been issued. The company controls the Mississippi River & Bonne Terre Railway and the Bonne Terre Farming & Cattle Co. By June 1917 it had acquired the whole of the properties of the Doe Run Lead Co. The St. Joe company owns directly 6444 acres of lead-bearing lands, 4244 of which are in the Flat River-Leadwood district, and 2240 in the Bonne Terre. By acquiring the Doe Run, it also owns mineral rights on 7054 acres in the Flat River-Leadwood and Doe Run districts. The estimated developed ore-reserves are 19,450,000 tons, and undeveloped 15,525,000 tons. Three mills are operated—the Bonne Terre, Leadwood, and Rivermines—with capacities of 2000, 2000, and 4000 tons daily, respectively. The smelter at Herculaneum, on the Mississippi river, has an annual capacity of 120,000 tons of pig lead. The output during the past five years was: 77,404; 84,356; 91,073; 94,820; and 79,620 tons of lead. The company also owns 1000 houses, tenanted by employees, and operates mercantile stores. Dividends since 1874 total over $21,000,000, plus 25% from the amortization reserve and 208½% as stock dividends. The net income from all sources last year was $5,121,164. Dividends amounted to $2,819,004. Current assets total $5,493,191, and liabilities $771,712. Working assets include $481,946 for lead on hand and in process, $1,651,038 for materials and supplies, and $26,621 for net store accounts. The reserve for Federal taxes is $2,000,000.

TENNESSEE COPPER & CHEMICAL CORPORATION

Property: copper mines, smelter, and acid-plants at Copperhill, Tennessee.

Operating Officials: A. L. Tuttle, general manager, M. A. Caine, assistant.

Financial Statement: the Tennessee Copper Co., which is the operating company of the Corporation, made a net profit of $706,572 during 1918. The consolidated balance-sheet shows current assets to be $2,669,252, and liabilities $642,163. The net bonded indebtedness is $1,453,391.

Dividends: No. 26 absorbed $400,000.

Development and Mining: extensions totaled 2858 ft., mostly in the Burra Burra mine. This cost 20.17 cents per ton. Diamond-drilling in 21 holes amounted to 3579 ft., at a cost of $2.539 per foot. The Burra shaft was sunk from No. 10 to No. 12 level. North and south drifts on No. 10 opened good ore. A brick change-house of 308-men capacity was erected. No. 7 level of the London mine opened well in the north. Not much work was done in the Polk County mine. Ore-reserves in all mines total 3,480,911 tons, of which 3,182,819 tons are in the Burra Burra, plus 134,910 tons broken in stopes. Mining cost $1.3747 per ton.

Smelting and Production: the blast-furnaces reduced 568,131 tons of charge, using 32,584 tons of coke and 703 tons of pulverized coal (the latter being tried in one furnace). Smelting cost $2.16554 per ton of ore smelted, and converting 1.061 cents per pound of copper. The company ore—402,071 tons—yielded 9,750,008 lb. of copper, plus 69,830 lb. from leaching flue-dust.

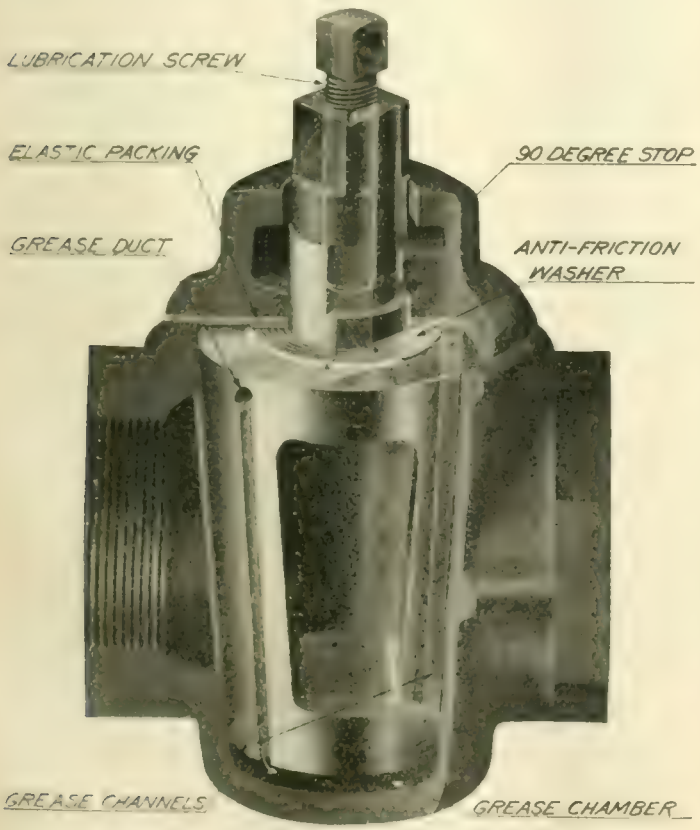
The two acid-plants made 283,092 tons of 60° sulphuric. All costs amounted to $4.49788 per ton of ore, equal to 18.526 cents per pound of copper. Powdered coal is being used successfully in the blast-furnaces.

INDUSTRIAL PROGRESS

INFORMATION FURNISHED BY MANUFACTURERS

A LUBRICATED PLUG-VALVE

Standard plug-cocks and gate-valves on pipe-lines in mills, cyanide plants, and other works, are frequently the cause of much bother from becoming 'frozen', followed by their being broken. This happens in spite of grease and cleaning, and we have known of large plants where one man was kept busy doing this. Accompanying these notes is a diagrammatic view of a new, though thoroughly tested, plug-valve, the invention of S. J. Nordstrom, who was engaged in the design, construction, and operation of cyanide plants in Mexico. For over three years this valve has been



in use, particularly at Pachuca and El Oro. It has also been adopted as standard equipment at several plants in place of ordinary plug-cocks and gate-valves for cyanide solutions, slime, water, and air.

The basic principle of the Nordstrom patent is the combination in a plug-valve of lubricant conduits and a lubricant chamber at the base of the plug so positioned that when pressure is applied to the lubrication screw, this pressure operates to lift the plug from its seat and simultaneously to distribute lubricant over the bearing surfaces. A flexible packing is provided between the body of the valve and the cover. This packing also rests upon an anti-friction washer forming the thrust bearing of the plug. This thrust bearing is grooved concentrically to prevent leakage. The flexible packing furnishes the necessary elasticity to allow the plug to be forced from its seat for the purposes of lubrication and to force the plug back into its seat when the pressure in the lubricant chamber is released. The position of the lubricating conduits and of the lubricant chamber are clearly shown in the illustration. A stop is cast as an integral part of the plug and cover and is so positioned that the lubricant conduits can never be exposed to the fluid passing through the valve. From the construction it will be evident that no matter how firmly the plug may be stuck to the body of the valve, when force is applied to the lubricating screw, a pressure is created in the grease-chamber at the base of the plug, and that this pressure must either raise the plug from its seat or else break the body of the valve. For greater convenience in assembling the valve, the cover-bolts are provided with slotted lugs and a special nut is used to prevent the bolts from slipping when tightened.

Suitable lubricants are supplied in the form of convenient cartridges, which fit loosely into the lubricant conduit when the screw is removed. Several grades of lubricant are supplied to suit the special conditions under which the valves may be used. For general purposes, the No. 1 lubricant will be found satisfactory, but **The Merrill Company** of San Francisco, part controllers of the patent, advises that its special lubricants should be used as directed for certain kinds of service.

An inspection of the various makes of standard plug-cocks, now on the market, will reveal the fact that the area of the opening in the plug is frequently no more than 60% of the area of the pipe. In other words, in many cases the effective area of a 3-in. plug-cock will only be equal to the nominal area of a 2½-in. pipe. All types of the Nordstrom plug-valve are so designed as to provide a full 100% opening in the plug. These plug-valves are made with a parallel opening through the plug to minimize the friction of flow and to increase the life of the valve. The flanged type of valve is constructed along lines that ensure a high hydraulic efficiency, and the firm recommends this type particularly where such efficiency is an object. The shank of the plug of all Nordstrom valves is finished and, when specified, wrenches will be provided. These wrenches fit snugly on the head and are held in place by means of a set-screw.

COMMERCIAL PARAGRAPHS

The Mexico Realty & Development Corporation and Arturo M. Martinez announce the opening of their offices at the Equitable building, New York.

The 'Standard' ball-mill is shown in a leaflet issued by **Collins & Webb** of Los Angeles. The 5 by 4-ft. is a popular size. It will crush 70 tons of sulphide ore through 30-mesh in 24 hours.

To keep pace with its rapidly growing business in the South-West, and to render to its many customers better service, **The Paraffine Companies, Inc.**, recently moved its Los Angeles offices to 903 North Main street. Stocks of the

firm's products are warehoused in a large building adjoining the new office.

The Burrell gas-mask for industrial gas protection is briefly described in a booklet of **The Mine Safety Appliances Co.**, of Pittsburgh, Pa., for which **E. D. Bullard** of San Francisco is representative.

The Dorr Company, New York and Denver, has issued Bulletin No. 13, describing the Dorrco pump. This is a 16-page publication containing tables of dimensions, weights, capacities, etc., part lists, instructions for operating, and illustrations.

In Catalogue No. 7, the **Standard Spiral Pipe Works** of Chicago discusses its reinforced spiral pipe, with continuous interlocking seam, no rivets, and smooth inside; also its forged steel flanges. This firm also specializes in drop forgings. Price-lists are included.

The Sullivan Machinery Co. of Chicago announces the establishment of a new branch-office at Room 810 Park building, Cleveland, Ohio, under the management of Ralph T. Stone, for several years past sales engineer associated with the New York office of this company.

B. F. Wade, recently discharged as lieutenant in the U. S. Army, is now representing the **Redwood Manufacturers Co.** of San Francisco at Chicago with offices at 811 Lumbermans Exchange building. He was prior to the War chief engineer for the Redwood Manufacturers Company.

Paul M. Einert, aged 56, died suddenly on June 5, at his home in New York. He entered the accounting department of the **Westinghouse Electric & Manufacturing Co.** at East Pittsburgh in 1900. Since then he went to this company's foreign branches in France and England.

H. L. Garbutt, for the last six years manager of the line material section of the **Westinghouse Electric & Manufacturing Co.**, East Pittsburgh, Pennsylvania, has been appointed manager of the supply division of the Westinghouse San Francisco office.

In Bulletins 48701-A and 48713, the Sprague Electric Works of the **General Electric Co.** describe and illustrate electric dynamometers and the adjustable loop system for overhead material handling machinery for terminal sheds, respectively.

In Pamphlet No. 9-C, the improved impact-screen for the wet and dry sizing of all kinds of materials is described by the **Colorado Iron Works** of Denver. The limits of these machines are about ¼ in. and 80 to 100-mesh. This company's screen is used in many large works making greatly varied products.

H. H. Hallowell, sales manager for the **Western Machinery Co.**, is touring Nevada, Utah, and other Western mining districts, visiting the various representatives of his company and appointing new representatives in open territories. He reports conditions throughout these fields as being favorable, and states that his company is securing good business for Western engines and hoists.

In its 48-page catalogue, No. 63, the **Armstrong Mfg. Co.**, of Waterloo, Iowa, for which **H. C. Kaufman & Co.** of Los Angeles are Western distributors, a great deal of useful information will be found on drilling machinery, tools, and supplies. A reprint of the notes of W. R. Grunow on churn-drill prospecting at Morenci, Arizona, where Armstrong drills were used, will be found in its Bulletin No. C D. 2.

J. W. McCabe, who until recently has been district manager of sales for the **Chicago Pneumatic Tool Co.** at Buffalo, New York, has been appointed special representative for the company's foreign trade department, and will leave shortly for an extended trip through the Orient, the Philippines, and Australia. W. H. White has been appointed acting district manager of sales at Buffalo to take charge of that territory during Mr. McCabe's absence.

The S. F. Bowser Co., Ltd., of Toronto, Ontario, manufacturers of oil-tanks, pumps, and storage systems, was organized as a Canadian company on April 1, 1919. The firm has for a number of years been manufacturing and selling these products under the control of the parent company at Fort Wayne, Indiana. The Canadian business has grown steadily, practically the entire Canadian trade being supplied from the Toronto factory. The company issues a monthly called the 'Bowser Boomer'.

The Minneapolis Steel & Machinery Co., of 154 Nassau street, New York, announces the expansion and development of the service of its office to facilitate the handling of domestic sales in the eastern part of the United States, and to serve the Eastern representatives of all clients. J. A. Teach, contracting, mechanical, and structural engineer, is now making his headquarters at the New York office. C. W. Hadden will continue his duties as export manager. This office is now prepared to design and quote on steel structures and mechanical equipment, and solicits inquiries. It is also prepared, and will be pleased to give complete information covering the Twin City products, including tractors, and conveying machinery.

The Genter positive thickener (patented) is described in a 12-page bulletin issued by the **General Engineering Co.** of Salt Lake City. This thickener effects a separation of the clear liquid from the thickened unfiltered material through a series of cylindrical filter elements, which are continuously held in submergence in the material to be thickened. The filter medium is kept free and cleansed of a minimum cake accumulation by filtrate counter-current, while both sides of the filter medium are kept in submergence in a pressure chamber. The capacity is from 0.3 to 0.8 gal. per sq. ft. per min., or for 1000 to 1200 tons of liquid per day about 400 sq. ft. of thickening area will be necessary, varying, of course, with the character of the pulp.

'Vulcan Soot-Cleaners for Return Tubular-Boilers' is the title of a new bulletin just published by the **Vulcan Soot Cleaner Co.** of Du Bois, Pa. This publication describes the model M front-end type and the model R rear-end type. Since 1906, approximately two million horse-power of return tubular and Scotch marine boilers of many different types were equipped with these two cleaners. The bulletin shows how the cleaner is installed in settings of typical construction. It gives the results of tests conducted by the engineering department of the University of Illinois and by the Iowa Soldiers' Home, at Marshalltown, Iowa. All engineers who are anxious to save coal, who operate tubular boilers, and who are troubled with soot, should have a copy of this bulletin.

The New York Testing Laboratories, which have been organized by L. R. Seidell, G. B. Jack, Jr., and H. H. Geist, formerly chief metallurgist, assistant chief metallurgist, and chief chemist, respectively, of the Wright-Martin Aircraft Corporation, have in addition to their well-equipped laboratories at 354 Mulberry street, Newark, New Jersey, opened their New York offices at 74-80 Washington street. In addition to chemical and physical testing and micro-photography, this organization is specializing in the source inspection of materials, and as consultants in smelting, foundry, drop-forging, and heat treatment practices, and the metallurgical investigation of shop troubles. They are also making chemical investigation of various ores and mineral deposits, their application to industrial purposes, and possibilities of marketing same.

COPPER mines in Australia are idle on account of the large stocks of the metal on hand. Only two of the larger companies are operating. Meanwhile the question is being raised in London as to whether copper should be imported into England from the United States to the detriment of the mining industry of Australia. It is suggested that a subsidy might be paid on Australian copper in order to assist competition with the American product, but we doubt greatly whether anything of the kind will be done, because such uneconomical production would be contrary to British ideas of free trade. Once the effect of peace has been felt in the re-establishment of industrial activity in Europe, the consumption of copper will provide a normal method of liquidating the stocks of metal in Australia and elsewhere.

GOLD producers in India, namely, in the Kolar district, to which the productive mines are confined, have been allowed by the Government to make an arrangement by which they sell about half their output for rupees and thereby save the loss in exchange involved in remitting the whole of the gold to England and then sending back the amount required to cover local expenses. On this the 'Financial Times' remarks: "This is a useful concession so far as it goes, but it tends to confirm the fear that the gold mines in general are not going to be allowed to make the big profit hoped for at one time out of the abnormal prices current in certain directions for the relatively small free supply of the yellow metal. It is said that in India and the Far East—that sink of silver and gold—the last-named metal has been fetching £1 to £2 per ounce over its standard price." Yes, a free market for gold and silver will best suit the miner, but what is spoiling the market for gold, of course, is the superabundance of paper money.

IN the article on 'Progress in Methods of Exploration' by Mr. Hugh M. Roberts, of Minneapolis, our readers will find an interesting discussion of the value of the diamond-drill as an instrument for finding ore and for ascertaining the dimensions of an orebody. Undoubtedly this method of exploration has gained in usefulness, not only because the tools needed for the purpose have been made more efficient, but because the mining engineer has learned to make correct deductions from the information obtained in the course of his drilling. Above everything the diamond-drill is a saver of time, which means money in enterprises involving large amounts of capital and engaging the services of an expensive staff. One of the most striking demonstrations of the value of the drill in prospecting was made at Ajo, as Mr. Roberts points out, quoting Mr. Ira B. Joralemon's account of the work. As a sampling implement, the diamond-drill has proved useful, particularly in deposits that are low-grade and comparatively homogeneous, as in the disseminated copper orebodies of the South-West, but in precious-metal mining the drill remains a dangerous tool for sampling, except when used to a prodigal extent.

VARIOUS plans for restricting immigration are before Congress. One is the percentage plan for regulating the influx of foreigners into the United States. This is based on the proposal to permit the entry of only so many immigrants of each people or mother-tongue group as can be wholesomely Americanized, the number of those individuals of each group already Americanized becoming the basis of measure for the further immigration of their compatriots. As against the reasonable anxiety to exclude undesirable aliens, particularly anarchists and other subverters of orderly government, it is to be noted that large numbers of foreigners, that is, non-naturalized residents, are returning to Europe. In one day 5000 Italians left New York in three steamships. The monthly departures now exceed 30,000. It is reported that 25,000 passports are on file, approved, while the owners await space on outgoing steamers. From these departing aliens the Government has collected more than a million dollars in income-taxes since April. It is estimated that this exodus will include 1,300,000 aliens, who will take with them a total of about four billion dollars in savings. In the interval between July 1, 1914, and April 1, 1919—which covers the period of the War—the excess of immigration over emigration was only 514,812 persons, as compared with an excess coming this way of 1,764,934 in the two years preceding the War. If the earlier rate of immigration had continued we would today have 3,675,000 more people in this country than we have now. The subject is one of great importance. The United States was made by immigrants from other lands; its industrial prosperity depends largely upon an adequate supply of labor; yet every thoughtful citizen is anxious not to lower the standard of living or of life by admitting either the pauperized or the unruly elements from Europe. Much of our undesirable immigrant population was brought hither in the course of steamship competition that reduced the rates of passage to a minimum permitting the poorest and most ignorant to cross the Atlantic. The ordinary tests for political outlaws are

worthless, because anarchists and bolshevists find no difficulty in complying with the requirements of Ellis Island, and, unless notorious characters, they cannot be spotted. We hope that Congress will go into this matter earnestly and carefully with a view not of closing the United States to the undeservedly unfortunate of other less favored lands but with the purpose of excluding those unable or unwilling to assimilate with our people.

DURING recent months we have criticized the enterprise of the Colorado Pitchblende Company and given reasons for doubting many of the optimistic estimates contained in the circulars and advertisements issued by that company in the course of its stock-peddling activities. The end has come rather sooner than we expected. On May 29 the State Bank Examiner of Colorado closed the City Bank & Trust Company's bank at Denver because of a shortage caused by the cashing of worthless drafts drawn by J. S. Barnhill, the president of the Pitchblende company, in collusion with Robert A. Brown, the cashier, and other subordinate officers of the bank. It appears that through promises of highly salaried positions in his mining company, Barnhill induced three of these officials to join in a scheme that finally rendered the bank insolvent. Cashier's checks were issued to Barnhill for large sums in return for drafts which he presented to a bank at Burley, in Idaho. At first these drafts were honored, but finally three of them, amounting to $140,000, were protested, and the Denver bank was forced to close. The cashier's checks had all been made payable to the Western Union Telegraph Company and Barnhill had wired the money to some banks in Idaho. Warrants for the arrest of Barnhill and Brown were issued promptly, but both had gone to parts unknown. On June 26 the cashier surrendered to the sheriff at Denver. Barnhill is still at large. The metallurgical operations of the Pitchblende company during the interval have proved abortive. This fiasco should serve as a warning to the Colorado Manufacturers Association, which endorsed Barnhill's flamboyant advertisement and deprecated the criticism of domestic industry, even when technical men of good repute had gone out of their way to warn the public against buying stock in this unfortunate enterprise.

SEVERAL of our friends have received copy of the 'First Financial Report', being a prospectus issued by Mr. E. G. Lewis, of Atascadero, California. It is a pleasant-sounding address and Mr. Lewis has made a number of romantic statements quite in keeping with the Spanish names on his letter-head. The "report and statement," as it is called, gives "the results of my first year in mining," says Mr. Lewis. What is remarkable about the ornate and prettily illustrated pamphlet is the writer's confidence—after one year of experience—in his ability to tell the public what is a good mining venture, and, presumably, what is not. He amuses us by quoting one of our own remarks on mining speculation as a text at the head of his first chapter and by coupling it with an aphorism by the late James J. Hill. He is modest withal, giving credit for his success in this "first year of mining" to Messrs C. E. Gilman and Granville Moore, gentlemen not unknown in San Francisco and Denver respectively. This ingenuous report is issued by Mr. Lewis for the purpose of selling some $750,000 in bonds, on his personal note, in order to finance several projects that apparently need financial sustenance. The most curious item in the pamphlet is the description of a new ozone process, which is one more of those marvelous chemical methods which will treat every kind of ore in a jiffy and at a trifling cost. "A remarkable thing about the action of this new reagent," says Mr. Lewis, "is that not only are smelting ores thus treated in a few moments, but ores too refractory even for the smelter, are treated with equal success." Moreover, according to Mr. Gilman, the process "seems to have the power of dissociating atoms either chemically or mechanically combined." That is a fearsome feat. We do not wonder that it has been found necessary to remodel the plant. We see no reason why Mr. Lewis and his friends, all of whom seem to be honest, should not make experiments and even write about them, but until they know more about the technique of mining and metallurgy they should abstain from persuading an innocent public to embark with them in their South Sea enterprises.

Prohibition

See America thirst! The fateful first of July has passed and the water wagon becomes the symbol, the triumphal chariot, of a new morality. In those closing days of June when two great events were impending, peace and prohibition, it must be confessed that in this community the imminence of a 'dry' period stimulated more earnest conversation than the legal ending of a world war. The average man is more sensitive to anything that touches his personal comfort than to the meaning of even the most portentous events outside his individual experience. Therefore many of our citizens were greatly troubled, and in their trouble they talked a good deal of nonsense. For instance, they protested against the restriction of their personal habits as though it were contrary to the Constitution, the Ten Commandments, and the Fourteen Points. Is not the art of living in a community based upon all sorts of restraints and inhibitions of such personal conduct as might prove unpleasant or injurious to one's neighbors? Surely the whole idea of civilization is founded upon the self-surrender of the privilege to do as he pleased that man enjoyed during his jungle existence. He surrendered his 'natural' rights when he accepted the protection of the law. The notion of unrestricted personal liberty leads straight back to the unmitigated selfishness of savagery. In a democracy, which pre-supposes mutual consideration and a willingness to sacrifice freedom of individual action for the good of the whole body politic, it is absurd to exclaim at a restriction that has been approved by the representatives of the people after due and careful de-

liberation. Personally we are prejudiced against prohibition; as an individual we dislike it, because it debars us from beverages that were wholesome and palatable, but we bow to the will of the majority in this republic. At the present moment it is being shown again that the United States is a country of quiet majorities and vociferous minorities. The larger number of the American people desired prohibition, and they got it in a proper way through their representatives in Congress and in the State legislatures. The amendment to the Constitution may seem objectionable to some of us, but it will stick. No well informed person can imagine for a moment that there will be a speedy reaction against the law forbidding the sale of intoxicants in this country. The experience of the States that 'went dry' in advance of Federal prohibition is dead against such a hope. Where prohibition has been adopted, it is popular, for several reasons; it promotes thrift and increases business; it helps the women by preventing the men from squandering their wages; it is a factor of safety in the performance of dangerous work; it increases efficiency in every form of labor. These are real gains, against which the loss of sociability, the decrease of vivacity, and the deprivation of self-indulgence however harmless seem trivial indeed. It is true, of course, that to the average working-man an occasional drink is a counter-irritant when his temper is on edge, and it may be that an increase of unrest in the ranks of labor may ensue from the self-repression imposed by prohibition, but against this must be set the stimulation to disorder, especially during times of strike, caused by the excessive drinking of intoxicants, or, more often, by the moderate drinking of the poisonous stuff usually sold in the saloons of a mining settlement. New habits are not easily acquired by men no longer young, and for this we make due allowance. The weakness of the argument against prohibition is exhibited pathetically in the two articles, for and against, appearing in the current issue of 'McClure's' magazine, in which so clever a writer as Gertrude Atherton is able to present only the feeblest retort to Dr. Frank Crane's defence of the new law. The bugaboo of the drug habit is being raised by the very people who contend that prohibition cannot be enforced; they insist that the lack of drink will provoke the use of narcotics and in the same breath assert that the law against alcoholic liquor will be a dead letter. Our own opinion, backed by statistics, is that the decrease in drinking will cause a marked increase in the consumption of candy, because the human system needs some alcohol and will generate this requisite from the sugar that is eaten in various forms, such as the *eau sucré*, or sugared water, that many elderly Frenchmen sip habitually. An excess of candy will poison some people, as too much whiskey has poisoned others, but the results are not equally harmful, so let it go at that. Larger consequences impend. The annual expenditure incurred by the American people on account of spiritous liquors is about $2.500,000,000. The Government will lose some $440,000,000 in taxation, but the thrift induced by prohibition will render available a large volume of capital for more useful purposes. Again, the improvement in credit, when borrowers have ceased to yield to the temptation of becoming drunk, will be an important commercial factor. Next, the cesspools of the city—the brothel and the saloon—will become less potent factors in the community, for vice thrives upon intoxication. Another thought comes to allay our annoyance at the thought of a perpetual aridity; we remember the bright and capable men, the clever and charming friends, that succumbed to intemperance and went to a premature grave. We would forego a good deal of wine to have some of them back. But, after all, the strongest argument for accepting prohibition in a docile temper is the fact that a republic is governed by its representatives and when a majority of those representatives enact a law it is for us to obey it, pending, if we insist, the legalized procedure for repeal. To talk about resisting the law or to suggest the failure of juries to convict for infractions of it is undemocratic. Whether a man may or may not take a drink is immaterial as compared with the question whether he will behave as a citizen or as an outlaw. We feel confident that the people of the United States will accept prohibition in good faith, and we anticipate that once established the new order of life will persist indefinitely.

Carranza's Mexico

Signs are multiplying that even the long-suffering administration at Washington is becoming vexed with the Mexican government of Señor Venustiano Carranza. The policy of watchful waiting was well meant and might have succeeded if this leader of the so-called Constitutional party had made the most of the chance given to him, by the American government, to establish law and order in Mexico. It is announced that "urgent representations" have been made to the Mexican government for the punishment of those responsible for the murder of John W. Correll, an American citizen, the maltreatment of his wife and the attempted murder of their son, at their ranch near Colonia, 27 miles north of Tampico. The mention of the locality is significant because a few days after Correll had been murdered the paymaster of the Gulf Refining Company, an American enterprise, was 'held up' and robbed of $15,000 in gold which he was taking from Tampico to the oilfield; and this was done after the local authorities had been notified of the route he would take and of the need for protection in going about his regular business. This was in so-called Carranza territory, that is, a region dominated by Federal troops, who, however, not only failed to give the proper protection to legitimate industry but, some of them, in uniform, actually raided a camp of the National Oil Company, at Panuco, and robbed the employees of their money and valuables. On top of these items of lawlessness, it is reported that the Mexican government has prevented American oil-drillers from working on land that had been purchased from its Mexican owners in the ordinary way, that is, it was not a Government

concession, but private property. These incidents are in no way remarkable, more than 300 Americans have been killed in Mexico during the revolutionary period of the last eight years and American properties innumerable have been looted or destroyed; the recent happenings have fresh significance only because they mark the near approach of a limit to the patience with which the American people have waited in the friendly hope that the Mexican would set his house in order and become a respectable neighbor. It is, of course, not a little absurd that a government with a mission to assist in the establishment of civilized methods in Armenia and Dalmatia should shirk obligations at its back door. Apparently—and the wish may be father to the thought—the Administration at Washington is ready to turn from the consideration of mandatories far across the seas to the acceptance of a more logical and more pressing mandatory across the shallow waters of the Rio Grande. It is about time. Every intelligent citizen in this country must be tired of the *opéra bouffe* varied by blackmail, rapine, and massacre that has flourished for nine years in Mexico, into which American men and American capital were cordially invited to come by Porfirio Diaz during the more than thirty years of his presidency. These alarums and excursions at Columbus, Cananea, and Juarez are ceasing to be even picturesque. We understand why a filthy brigand like Villa and a crafty desperado like Zapata are enabled to continue their depredations year after year in mockery alike of the *de facto* and *de jure* government of the pompous ass who is ready to ally himself with any enemy of the United States that makes him an offer of money. Only recently two American mining engineers, Harry White and W. L. Tovote, were killed, it is said, by the Yaqui Indians, just as if the Yaquis were not Mexicans, who themselves are Indians. This talk of Latin America and Spanish America is mere camouflage, the fact being that our southern neighbors are Indians with a slight admixture of alien, chiefly Spanish, stock; and even that small infusion of European blood has become less influential during the disorderly period since Diaz resigned, because the larger part of the Spanish population has emigrated to a safer domicile, shirking their responsibilities and leaving their hapless country to the more ignorant *mestizos* and the full-blooded *indios*. Mexico today is only 10% white, and, what is even more significant, it is 85% illiterate, in this respect being comparable with Russia, which, like Mexico, therefore is entirely unprepared for any form of representative government. Since Humboldt's visit, in 1810, the mixed population of Mexico has more than doubled. Both Diaz and Huerta belonged to this group. Even the undiluted Indian has risen to positions of power. We are not dealing with a Spanish colony but with a people among whom liberalism works as an explosive and to whom the contact with our material civilization has been the cause of persistent political ferment and systematic corruption, such as flourished, say, in the time of Louis XIV or Charles II. Mexico is in the kindergarten of social evolution. Consider Carranza's attempts to administer the country with a combination of crazy idealism and sordid craftiness. He is not a soldier, he rose to power by means of the military ability—at least for the sort of fighting that obtains in Mexico—of Villa, Obregon, and Angeles, all of whom are now opposing him. He holds his remaining generals only by permitting them to graft at their pleasure. The Federal appropriations passed by the Mexican Congress for 1918 included 120,755,631 pesos for the Department of War and Marine; this was two-thirds of the entire budget and nearly all of it went to the army, which nevertheless is unable either to drive Villa's band of outlaws into the mountains or to make a decent showing when he puts up a fight periodically. The reason why the Federal troops are so ineffective is because the money voted for their maintenance is squandered by the generals in riotous living in the City of Mexico and because the officers in the field actually sell arms and ammunition to such bandits as Villa and Zapata. Although the latter is dead, others of his kind are numerous. The military authorities have to be bribed in order to get anything, from the use of a railroad car to the permission to employ labor. The names of 37 defaulting army paymasters have been published in the newspapers of Mexico City. Carranza's revenue largely exceeds that collected by Diaz, and he gets it not by just taxation but by confiscation, which has paralyzed industry. Much of the rolling stock of the railways has been destroyed during the guerilla warfare and what has survived is so out of repair that only two lines, those from Laredo and from Vera Cruz to the capital, are able to maintain a regular service. The population in the bigger cities, such as the capital, Vera Cruz, Guadalajara, and San Luis Potosi, has been increased abnormally by thousands of utterly destitute people, brought thither largely by the fear of living in the country, where they are the victims of recurrent brigandage. Agriculture is neglected because it is unsafe to remain on the farm, the produce of which likewise is at the mercy of bands of marauders. The officers of the American Red Cross were requested by Carranza to leave Mexico in the latter part of 1915 after having begun a campaign of benefaction in behalf of the suffering poor. In Mexico City alone they fed 26,000 families daily, and they reported the conditions there, at Monterrey, Monclova, and Saltillo as appalling. Yet Carranza's adherents were permitted to ship 37,000 tons of foodstuffs through the port of Vera Cruz and to enrich themselves thereby. Potatoes have been sold at El Paso by the carload from Guerrero while the people living in that district were dying of starvation. In short, an incapable politician, supported by a motley group of military chiefs whose support is based on the privilege of unlimited graft, is at the head of an administration that is unable to perform the functions of government, that is, to protect its citizens, stabilize industry, and uphold the law. Mexico may have a government *de facto*, it has none *de jure*. It neither possesses the power nor shows the inclination to discharge its obligations either to its own people or to those of a neighboring country.

Considerations on the Treatment of Flotation Concentrate

By OLIVER E. JAGER

It may be stated as an axiom that flotation has come to stay, at least till we find something better. That there will be improvements in the process is also true, on account of its possibilities and of the large amount of intelligent experimentation that is being carred on. The high recovery obtainable with this process is its chief recommendation, though it must not be forgotten that a higher operating cost is attached to it, and that the total extra cost will absorb a quite appreciable percentage of the increased value recovered. It is of interest, therefore, to review briefly the new conditions that will arise when flotation is adopted as part of the ore-treatment process. Or, in other words, what changes, if any, must be made in the smelting process and equipment, and what differences are to be expected in the results, when a considerable proportion of the material to be treated consists of flotation concentrate.

In order to make any differences more apparent, we will assume the case of a smelting plant having a concentrator, the whole being in operation, and that the latter is about to install flotation. Changes necessitated in the milling machinery will not be discussed here, being outside the scope of this article. If the ore is of such character (unfortunately rare) that it does not require the fine grinding of a large proportion of the mill-feed, the amount of flotation concentrate produced will be small in comparison to the whole. Under these conditions, the addition of the small amount of flotation concentrate to the roaster charge will hardly be noticed. But if the ore has its valuable constituents finely disseminated, or if, for any reason whatever, a large proportion of it is finely ground, so that there is a heavy production of flotation concentrate, the effects due to the introduction of flotation will begin to manifest themselves in various departments of the plant.

The first difficulty is in the thickening of the flotation concentrate preparatory to filtering it. The point is, that a certain amount of residual froth will usually remain on the surface of the liquid in the thickening-tanks, and that this froth is not easily broken. While this annoyance is more marked in some cases than in others, it is nearly always encountered. Some plants succeed in breaking this residual froth by placing a spray-pipe around the inside edge of the tank top, so that the radial jets of water cut up the froth.

Assuming the flotation concentrate to have passed through the filters and been deposited in a bin, it then becomes necessary to get it out of the bin in order to feed it to the roasters. The belt-conveyors that worked successfully on the coarser material from water concentration will not handle the wet and gummy flotation concentrate, so that some other device, such as an apron-feeder, will have to be used. Having got the material to the roaster, the next thing to consider is the roaster itself. With the introduction of a considerable amount of very fine material, conditions will be changed, calling for certain adjustments on the furnace, such as speed, depth of charge, temperature regulation, etc., and every precaution must be taken against producing dust. Flotation concentrate is usually fed along with coarser concentrate from the tables and fine jigs, and in some cases the feed is very irregular as to size. It would be interesting to know whether a mixture showing a wide variation in size has any adverse effect on the tonnage or operation of the roaster. If there is a decided tendency toward agglomeration, the introduction of some inert material may be necessary. This is not a difficult matter, as fluxes are generally put into the roaster to ensure a proper mixing with the other ingredients of the charge. The liability of forming nasty hearth-accretions must not be overlooked. More dust will be produced when roasting flotation concentrate, which brings up the question of flues, and flue-dust handling and treatment. Once the new conditions are fairly established, investigation of dust losses may have to be undertaken in order to determine whether the existing flues are adequate to settle the fine dust now being produced. It will probably be found that some improved method of dust-catching will have to be installed, which naturally brings up the consideration of the Cottrell process, with the subsequent handling and treatment of the fine light dust resulting therefrom.

Having roasted the concentrate, the next step is to get it to the reverberatory furnace. On account of the fine nature of this product, it produces dust easily, so that arrangements must be made to prevent inconvenience and loss through dusting. The drop from the roaster-hopper to the car must be as low as possible, and should take place preferably through a pipe or covered chute. The car will probably need alteration, as it should be covered at the top as much as possible. On reaching the reverberatory furnace, a further quantity of dust will be produced when the hot material is dumped into the charge-hoppers. The covering of the reverberatory feed-floor would prevent a lot of dust getting away, but it would also make the place uninhabitable while dumping was in progress. About the only way to obviate this difficulty is to place light steel housings over the tracks on the reverberatory feed-floor. A kind of tunnel is thus

formed, large enough to allow the entrance of the roaster-cars, which are got at, for dumping, through doors on the sides of the tunnel. Assuming that the reverberatory furnace is charged along the sides, there will be less protection for the walls of the furnace with this very fine material, as it will not stand up in a heap along the side-walls like a coarser charge. There is also a greater tendency for the fine material to flux the brick of which the furnace is built. All this may necessitate a thickening of the side-walls and roof of the furnace. With a charge containing much roasted flotation concentrate, there is a chance for the fine dust to enter the slag and raise its metal content. See a previous article.*

When using water concentration only, the plant may have been equipped with some slime-settling arrangement, such as ponds, dams, etc. A change in the scheme of treatment will probably be made at this point, the slime being thickened in tanks and re-treated by flotation. This does not necessarily infer a lower cost of treatment, although it would obviate excavation and re-handling at the dams.

There has been considered here the case of a smelter having reverberatory furnaces, since the roast-plus-reverberatory seems to be the logical method of treatment for flotation concentrate. Another set of conditions arises in the case of a plant having blast-furnaces only. One plant of this class in the North-West is dumping flotation concentrate directly into the furnace in the form of thick mud. No figures are available on the ensuing dust-losses, but the method is open to criticism. However, it is worth mentioning as an expedient. In sintering flotation concentrate various difficulties arise with the grates, which means decreased draft and lower tonnage, even when some coarser material is mixed into the charge. Briquettes, even under favorable conditions, produce considerable dust in the blast-furnace, and it is not to be expected that the addition of flotation concentrate to the briquette-mill charge will lessen this evil. Nodulizing possesses some advantages, but there is little information available on this process, probably on account of its not being widely used. Pot-roasting requires a preliminary roast, in which the roaster troubles mentioned above would be involved, as would be the case should a pre-roast be given with sintering. Modifications of process will be necessary in any case, and may result in the final adoption of some combination method of special preparation of the charge going to the furnaces, all of which means more trouble and extra cost.

A custom smelter purchasing flotation concentrate will, of course, experience the above difficulties (with the exception of those connected with thickening) as well as the annoyance incident to unloading and handling a wet and gummy material.† The introduction of any drying process means added expense and loss of time.

In an article of this nature, one has, of course, to deal in generalities. While it is not suggested that all these effects will be felt at every plant using flotation or handling flotation concentrate, they are given to show the lines along which consideration must be made when there is a noticeable increase in the amount of very fine material to be smelted.

Copper Leaching at Kennecott

The following data from the operating records of the Kennecott Copper Corporation's ammonia-leaching plant at Kennecott, Alaska, represent an average taken over the period January to April, 1919, both inclusive, and cover salient points in current metallurgical practice:

	%		
Assay of leaching plant heading—carbonate copper	1.04		
Assay of leaching plant tailing—carbonate copper	0.22		
Extraction	79.2		
Average moisture content of heading	4.75		
Average assay first leaching solution	3.75	Cu, 7.70%	NH_3
Average assay second leaching solution	1.85	Cu, 8.60%	NH_3
Average assay of rich solution to stills	5.54	Cu, 8.37%	NH_3
Average assay of ammonia concentrate made by stills	17.1	NH_3	
Average assay of precipitate produced	75.8	Cu	
Average length of first leach (still)	13 hours		
Average length of second leach (circulating)	42 hours		

Average Consumption of Steam

	Lb.
For tailing wash:	
Per ton of material leached	108
Per pound of copper produced	6.4
For distillation:	
Per ton of material leached	226
Per pound of copper produced	14
Total steam:	
Per ton of material leached	334
Per pound of copper produced	2.04
Consumption or loss of ammonia:	
Per ton of material leached (100% NH_3)	0.55
Per pound of copper produced (100% NH_3)	0.033

Notes from the St. John Del Rey Report

During the year ended February 28, 1919, there was mined and treated at the property in Brazil 167,854 tons, yielding 99,874 oz. of gold. The profit was $570,000. Dividends amounted to $326,000. Some of the troubles were floods and influenza. The mortality from the plague was 2% of the cases; 75% of the population was afflicted. There were five fatalities at the property. During the past five years, 75.2% of the accidents were due to 'blistering' rock. There were 938 people employed, 28 being Europeans and 905 natives. Ore-reserves are estimated at 1,209,104 tons. The ventilating system was kept in good order, the Sirocco fans being stopped only 1 hour 37 minutes during the year. The temperature of the rock at a depth of 6100 ft. was 108° and the air 99°. This was during the four hot months. The initial rock temperature at the time of opening new levels was 98° at 4100 ft. and 116° at 6100 ft. The treatment works extracted 91.8% of the gold. Camshafts broke frequently, due to the poor quality of steel. Mine rock was used in the tube-mills, after being partly rounded in a rough mill. Assay crucibles and liners for graphite crucibles are made at the works. The manganese deposits were sampled and average from 47.27 to 51.36% Mn and 7.88 to 11.29% Fe. The hydro-electric plants supplied 134 motors with 3559 hp. at 2.7c. per day.

*Oliver E. Jager, 'Continuous Overflow and Its Effect on the Slag Loss of Reverberatory Furnaces'. M. & S. P., June 28, 1919.

†T. A. Rickard. 'The Utah Copper Enterprise'—IX. M. & S. P., Dec. 28, 1918.

The Chloride-Volatilization Process

By BLAMEY STEVENS

The idea of extracting metals from ore by a chloridizing roast and the simultaneous volatilization of the chlorides is due to Stuart Croasdale.[1] His observations of the character of deposits in smelter-flues and stacks led him to consider the practicability of volatilizing the major instead of the minor part of the valuable metallic contents by this action.

It has been known that the haloid compounds of most metals volatilize at much lower temperatures than the metals themselves, but many of the chlorides were also known to be unstable at high temperatures. This and other complexities may have previously discouraged other metallurgists; in fact, difficulties still stand in the way, but, remembering that cyanidation and flotation processes were developed without being well understood in theory, the pioneers of the present process are encouraged in their more or less blind endeavors.

The principal difficulty originally mentioned by Mr. Croasdale was the unsatisfactory precipitation of the chlorides. E. L. Blossom at that time (May 2, 1903) reported to the Montana Ore Purchasing Co. of Butte that "as applied to Rarus ore, the process is too far from a commercial possibility to be worth mentioning."

The first patent[2] was granted to Edwin C. Pohlé and Stuart Croasdale in 1903, but by this time Mr. Croasdale already had a plant erected and operating near Denver, Colorado, the Metals Volatilization Co. having supplied the capital. A. W. Hudson, now of Tyrone, New Mexico, was employed in making the practical tests.

Ben Howe[3] professes to have discovered the process some nine years later, and applied it, in Western Australia, to the treatment of antimonial gold ores. As with Mr. Croasdale, he reports his greatest difficulty to have been in dealing with the fumes.

With the invention of electrical precipitation[4] and its application, by F. G. Cottrell, to practical purposes, a new hope was opened for the chloride-volatilization process and this was plainly recognized in the discussion initiated by Mr. Howe's articles.

In 1906, O. H. Fairchild[5] described a plant erected at Mayer, in Yavapai county, Arizona, having four furnaces of the cement-kiln type 36 ft. long and 5 ft. 6 in. to 7 ft. 6 in. diameter of shell. There is no statement of the results obtained, but the venture is known not to have been a success.

About 1916 the Weldon Mining Co. of Canada took an option on some mining property in Nevada. Looking for a method of treatment, Mr. Adams, the president, persuaded O. C. Ralston, then of the U. S. Bureau of Mines, to undertake an investigation by the chloride-volatilization process[6] and experiments have ever since been carried on at their Salt Lake City station, latterly under the superintendence of F. G. Moses; Professor Bradford of the University of Utah, where the station is placed, has also made some study of the subject.

G. H. Clevenger of the Colorado Springs station of the Bureau of Mines has been especially interested in the recovery of potash from ores by a similar process. The recovering of the precious metals might, in fact, be combined with the recovery of potash.

The process as now applied experimentally consists of mixing salt or brine with the ore and roasting it in a current of air at a temperature as high as it will stand without sintering too much. The fumes are collected by the Cottrell electro-static process and may be treated in several different ways according to their character, the usual method being to mix them with the required amount of lime and a small amount of reducing agent and melt, recovering the valuable metals as bullion. The lime-chloride slag may be used in the roasting of more ore, so as to economize salt.

Owing to the liability of the ore to sinter, it is hardly possible to use any form of mechanical-rabbling furnace and from the first the cement-kiln type has been used. Since the interest of Edison was directed to the cement-making art, these furnaces have been made of great length, so as to economize heat by minimizing the difference in temperature between the gases leaving the furnace and the pulverzied material entering it at the same place.

The chloride-volatilization process, if placed upon a practical basis, might be useful in the following cases:

1. Desert ores, too much oxidized for flotation or other means of concentration.

2. Ores high in zinc and not suitable for smelting.

3. Ores that cannot be smelted because of the want of flux for the formation of a fusible slag or of a collector

[1] 'Engineering & Mining Journal', Aug. 29, Sept. 19, and Oct. 31, 1903. Henry A. Mather, Ibid., Sept. 5, 1903, and subsequent issues of the same journal.

[2] Pohlé & Croasdale No. 741,712, Oct. 20, 1903, and E. C. Pohlé No. 811,085, Jan. 30, 1906.

[3] 'Monthly Journal of the West Australian Chamber of Mines', Dec. 1912; 'Mining Magazine', March 1913, Dec. 1913, and March 1914.

[4] 'Mining and Scientific Press', March 29, 1913. Trans. A. I. M. E., Sept. 1918, and bibliography there given. Particulars of the process are also given by the owners, the Research Corporation, of New York. The Western rights are handled by the Western Precipitation Co., at Los Angeles, California.

[5] 'Mining and Scientific Press', Sept. 1, 1906.

[6] O. C. Ralston, Trans. A. I. M. E., Vol. LVII, p. 648. (1917).

such as lead or copper. Deposits distant from a railroad are especially liable to suffer from such deficiencies.

My first interest in the process was to obtain a satisfactory method of treatment of some Mexican silver ores that were not amenable to cyanidation. Experiments in the muffle-furnace showed that a good proportion of the silver could be driven off as chloride in a reasonable time, with the temperature below the sintering point. It then became necessary to investigate the practice. Accordingly I visited the Salt Lake City station of the Bureau of Mines, the plant erected by J. H. Hirt for an El Paso company, headed by a Mr. Biesel, and the plant of the Chief Consolidated Mining Co., at Eureka, Utah, in charge of G. H. Wigton.[7]

These were the only plants of working size and in each case the extraction obtainable by passing a moderate tonnage through the furnace was too low to be economical. In Mexico, P. A. Babb has conducted extensive experiments for the Blaisdell Co. at Pachuca, and G. B. Hinton has conducted experiments at his laboratory in Mexico City.

The theory of the chloridizing roast had been previously studied by Hofman[8], Greenawalt, and others. They were only concerned, however, with the old Washoe and lexiviation processes and the volatilization of the chlorides was simply touched on to the extent that they wished to avoid it and therefore keep the temperatures of the roasting hearths sufficiently low.

Croasdale considered that the salt reacted with the sulphides of the metals and oxygen to form sodium sulphate and chlorides of the metals, but laboratory experience shows that sulphides in quantities are detrimental and that the reaction of the salt on silica is even better suited to the formation of the metallic chloride.

Little is known of the gases formed, but it is evident that they must be complex, involving the formation of oxi-chlorides and other compounds of which little is known. An oxidizing atmosphere is said to be absolutely necessary, and apparently the good results usually obtainable in the laboratory are due to the facility of access of air to the thin layer of ore in the muffle.

The chemists of the Bureau of Mines consider that the vapor-pressure of the chloride is very small, and consequently that the solution of the chlorides in air must be very dilute. It is well known, however, that vapor-pressures are increased by an important ratio with a moderate addition of temperature. But it may be that this additional temperature brings about other chemical or physical action affecting less volatile compounds, and that these prevent the free formation or volatilization of the chlorides. If such be the case a certain amount of control might be obtained by the introduction of other reagents than salt, or in addition to the salt. On the other hand, if the idea of the Bureau of Mines is not correct and the principal practical trouble is in the formation, not the volatilization, of the chlorides, the remedy would evidently be to pass the ore through a low-temperature roasting-furnace with plenty of oxidizing surface and form solid chlorides before attempting volatilization in the high-temperature kiln. Whether or not this should be done, could be easily determined without the installation of furnaces equipped with mechanical rabbles.

I believe that the process deserves investigation by expert chemists, but it may well be that, like many other metallurgical problems, it will be first solved by men of less scientific education and more of that invaluable combination of originality and persistence by which so much is accomplished in every branch of industry.

[7] G. H. Wigton, Patent No. 1,264,586, April 30, 1918.

[8] General Metallurgy, pp. 83 and 114.

Accidents in Mining

*Mining is one of the extra-hazardous industries, employing more than 1,000,000 men in the United States of whom three or more out of every 1000 men employed are killed each year by reason of some accident. While complete data relating to non-fatal injuries are not available, yet reports to the Bureau of Mines for all metal mines in the United States, show that at least 250 men per 1000 per year are injured sufficiently to cause a loss of time. Approximately the same rate will apply to other branches of the mining industry.

In all industries there are a certain number of accidents that are inherent, for which it is impossible to place the blame on anyone. These equal about 50% in the mining industry. The responsibility for the remainder may be placed about equally on the operator and the employee.

The campaign of education for employees in the various industries has also been extended to the mining industry to the extent that many of the larger operators are making special efforts to educate their workmen in various ways. So far as accidents are concerned probably the principal thing that can be done along educational lines is to see that the employees are thoroughly instructed in the English language, and as to the dangers which they encounter when they enter the mine, and to furnish them, through their superintendents and shift-bosses, instructions as to how to avoid accidents and to take care of themselves. Much of this educational work may be done through safety committees, consisting in part of members from the various occupations in and about the mines, giving the miner an opportunity to make suggestions that he considers will prevent accidents in his particular working place. Many of the companies have these committees actively at work, and they are meeting with gratifying results.

ALL WASTE BROKEN in development in the United Eastern gold mine at Oatman, Arizona, is used for stope-filling, and additional waste required is broken in a waste-stope started for that purpose. This waste-stope is supplying filling at lower cost than that extracted from raises in the walls.

*Abstract of address by Albert H. Fay, U. S. Bureau of Mines, before the Mine Safety Conference at Duluth on June 20.

A Metallurgical Journey to Shasta, California—III

By HERBERT LANG

Sulphide Ores. The Kennett chlorination plant has sunk into decay, and a copper smelter has taken its place. The mule team has made way for the steam locomotive, the wagon for the train of cars. Instead of the minute working of an occasional 'jag' of ore or concentrate, a daily supply of more than a thousand tons comes to the big smelter, whose activities affect the life of remote mining communities. And with these changes has come also such a reduction in the cost of treatment that those ores which had been worked in a small way and frequently at a loss when $20 per ton was paid therefor, go through the big furnaces for $3 per ton, and even less. It will be worth while to examine into the developments which made such revolutionary changes possible.

Along the hills that border the Sacramento river on its west side, in the region between Redding and the mouth of the Pit river, is a mineralized belt in which, at intervals, lie immense bodies of base sulphides. The rocks that hold them, older than those in which the quartz veins are found, are themselves peculiar, but their characteristics in only one respect have a metallurgical significance. They are acid lavas, containing 70% of silica, and it is not a little strange that ores situated wholly within them and from which they are unquestionably derived, should prove so devoid of that constituent. This fact has made it necessary to go outside for a supply of acid flux and has stimulated the gold-quartz mines of the surrounding region into unwonted activity. The furnishing of flux for the smelters has become a business of vast importance, while the stamp-mills have relapsed into idleness.

This base-metal region does not end at the mouth of the Pit, for isolated lenses of ore are found east of the Sacramento, clustering about Bully Hill and Ingot, many miles from what may be called the heart of the district. Discovery has succeeded discovery until hundreds of orebodies have been revealed, among which are some now ranked among California's great mines; orebodies reaching a width of 300 ft., and others whose known length surpasses 1000 ft., have been worked, enabling the extraction of six million tons of ore containing 300,000 tons of copper, and worth, with the precious metals, more than $100,000,000.

These results have been obtained mainly from ores that at an earlier epoch would have been classed as low-grade, and now rank among the poorest that are treated by smelting. While at first a good deal of the ore contained much copper, rising to 7% in the case of the Iron Mountain deposit, the average material now handled does not assay above 3%. Concentration has come to the aid of smelting, but it cannot displace it, as smelting displaced amalgamation, chlorination, and cyanidation. What influence these processes have had upon each other will appear in the course of this writing.

I have spoken of these extraordinary ore deposits as valuable for their base metals. Let us examine into their composition, in view of the course of treatment now considered advisable, and endeavor to anticipate what, in the course of natural evolution, is likely to be done in the future. In the first place, the ores remaining are almost exclusively sulphides, the metals contained in them being iron, copper, and zinc, with smaller proportions of lead, arsenic, silver, and gold. The minerals in evidence are pyrite, pyrrhotite, chalcopyrite, bornite, chalcocite, and sphalerite, with others of less importance. The upper portion of the orebodies, at the surface and to a little depth, consist largely of limonite in an impure condition. None of the minerals is pure; all contain impurities, even those which are crystallized and apparently unmixed. Thus, the pyrite of the Hornet mine, when assayed, shows a small content of silver and gold, very small, to be sure, but invariable. The average precious-metal content of the pyritic masses is not far from $2 per ton, and this value does not seem to increase when the pyrite is intermixed with other primary sulphides. It is a fact, however, that certain surficially enriched ores show, as would be expected, a concentration of silver and especially of gold, and several instances are recorded of copper showing parallel enrichment. Surficial enrichment extends also to the gossan, in which there is not only no sulphur, but no copper or zinc. This is to be expected, and brings us to consider what the orebodies really are, and what variations have followed naturally from their decomposition. Speaking generally, there are three classes of ore, discriminated as follows: First, beginning at the bottom, there are the unaltered sulphides of iron, zinc, and copper, together with more or less gangue, of which I will speak hereafter. The sulphides are closely intermixed, as a rule, so closely that sorting is impracticable, the different minerals not being detectable by the eye. This statement, however, admits of some qualification because there are exceptions enough where a good selection is regularly made, as, for example, in the Mammoth mine, where an ore averaging 20% zinc (and therefore 30% sphalerite) is mined and sorted to give a 40% zinc product, which is shipped. The remainder, being average ore, was smelted for the copper, gold, and silver, at the Kennett works. Again, the Rising Star mine at Bully Hill produces ore of an average grade of 3% copper, but by careful sorting it can be divided into two classes, the first of which averages 6% copper, with perhaps $1.50 in precious metals. This also is sent to Kennett for smelting, the poorer material being reserved for concentration. Of the first class over 20,000 tons was

shipped last year. The sorting did not by any means get rid of all the zinc, but simply raised the grade in copper. Sorting has been carried on at all the large copper mines, to improve the shipping product, and likewise considerable masses of sulphides, comparatively rich in one or the other metal, have been discovered in the course of mining. For example, there existed in 1895 in the Iron Mountain mine a mass of chalcopyrite, of the kind typical of that mine, many thousand tons in weight, which averaged not less than 15% copper. Within it a chamber had been cut, the size of a bedroom, the walls of which showed absolutely nothing but solid ore. The Afterthought system of veins also has produced ore of this character in considerable quantity, although the unaltered sulphides carry only 3% copper, with 6 oz. silver and a little gold. A conspicuous example of surficial enrichment was seen in the Bully Hill mine, from which Capt. De Lamar drew great quantities of ore averaging 10% copper, and which in certain places carried $20 in gold. From this ore he made handsome profits, having his own smelter and converter plant. Before his time the mine produced secondarily enriched ores of the oxidized class, which were silver-milled with some success, but which changed at a moderate depth into complex sulphides of lower tenor and more refractory character, bringing operations to a standstill. Still earlier in the 'seventies the placer miners found rich gravel on the flanks of the hill and in ravines leading therefrom, from which they took much wealth, all derived from the croppings of the ore-lenses close-by. Altogether it is doubtful if there exists a better illustration of the various phenomena of surficial enrichment than in the mines of Bully Hill. The present workings, now 500 ft. deep, have reached the zone of unaltered sulphides, of which great quantities are exposed.

Inspection of the mines covered by an 'iron hat' shows their triplex character, since they invariably show the gossan or oxidized portion, the underlying enriched sulphides. and the unaltered sulphides beneath. The gossan is sometimes of present value and of greater prospective value, since it contains at least a little of the precious metals, and is basic in character, holding more of the oxides than of silica, and hence affording a valuable flux for smelting purposes. Except for its impurities, by which the percentage of iron is too much diminished, the gossan might be looked upon as an iron ore, likely at some future time to be worked as such. For the present there is little likelihood of this use being made of it. Enormous quantities exist; in the Iron Mountain mine, for example, one finds it exposed on a great scale, a long adit penetrating such ore for several hundred feet, assaying about $2 per ton in gold and silver, and almost devoid of sulphur.

The various sulphides are far more regular in their distribution. In some mines, the Iron Mountain, for example, pyritic iron (by which both pyrite and pyrrhotite are meant) constitutes by far the larger part of the mass. In this mine, speaking of its great sulphide lens, now exhausted, pyrite must have made up fully three-fourths the 1,750,000 tons of ore upon which first smelting operations were based. We may say now of this orebody that it averaged 7.4% copper, 80c. in gold, and 2 oz. silver per ton. Certain parts were extremely rich in chalcopyrite, while other parts were correspondingly poor. Large masses, aggregating hundreds of thousands of tons, carried only 1 or 2% of copper, and were only fit for making acid. The same thing is measurably true of other deposits in this district. In the eastern part there seems to be less pyrite, and consequently less sulphur. Sphalerite also is distributed irregularly. There was scarcely any in the Iron Mountain lens, while in the northern and eastern parts of the base-metal range it is extremely abundant. The charge of the Mammoth blast-furnaces averages almost 4% zinc, which corresponds to 6% sphalerite. It has been so abundant in the Bully Hill ores as to prove a deterrent to smelting, and has defeated the efforts of the Afterthought smelter to run successfully, whereby that great property has been driven to apply other methods, as we shall see.

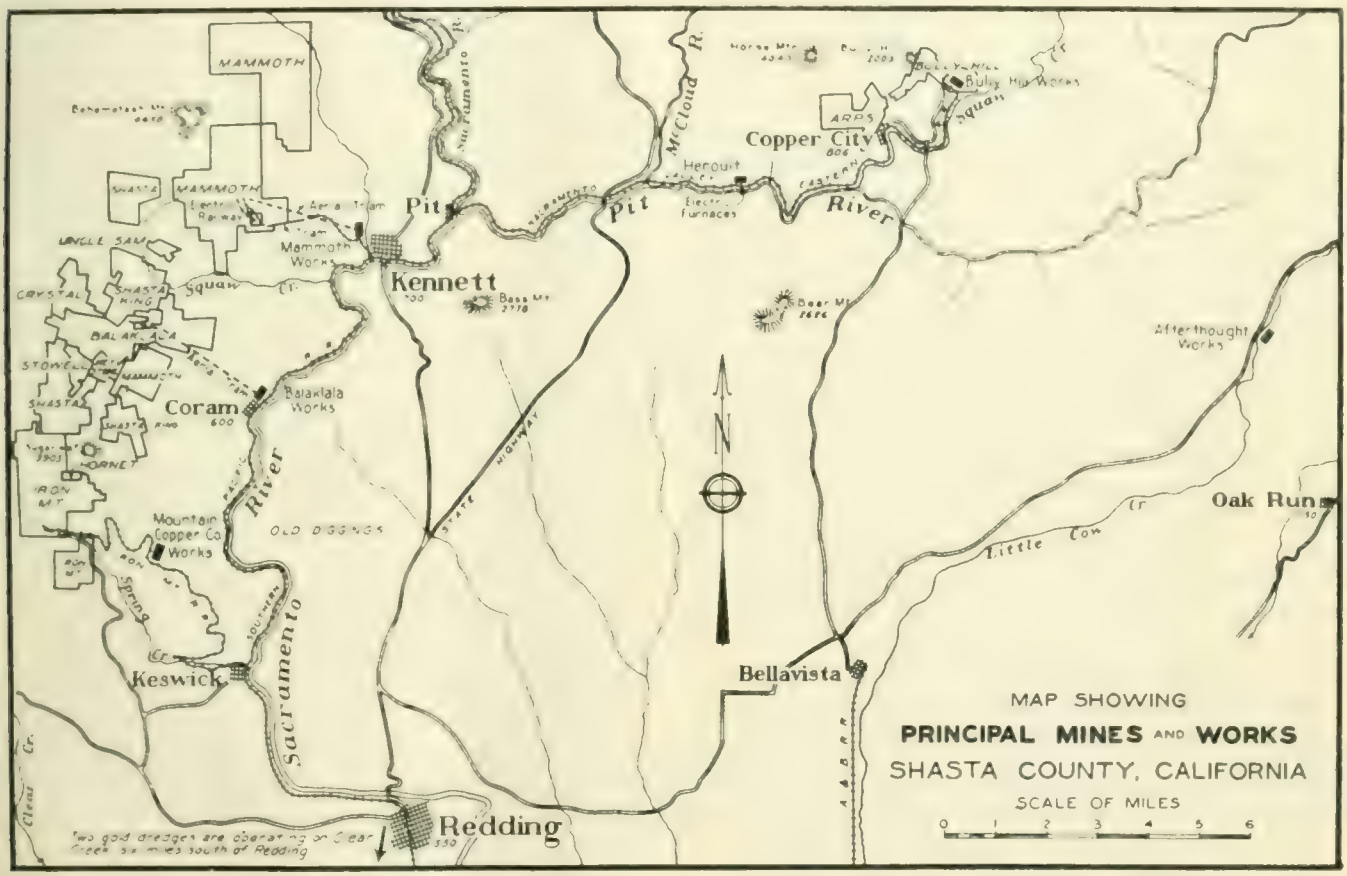
Masses of Pyrite. At several points in the base-metal range there exist bodies of comparatively pure pyrite, which being poor in copper and the precious metals, have not been utilized as yet by the smelters. Their exceptional freedom from arsenic or other injurious constituents, and their high sulphur content, makes them peculiarly adapted to the manufacture of sulphuric acid; relatively small quantities have been shipped to the neighborhood of San Francisco, and burned for that purpose. The Hornet mine, near Iron mountain, the property of the Mountain Copper Co., is such a pyritic orebody, and within its bounds a compact mass weighing no less than 6,000,000 tons has been explored. In other parts of the range similar, but smaller, bodies of this nature exist, in particular in the Rising Star mine, at Bully Hill. A little copper is invariably found in these pyritic ores, but only a little. The Hornet ore is supposed to average about 1.5% copper, with a little over a dollar in precious metals. It carries also a trifle of zinc, and a few percentages of silica, etc. This ore, on being burned at the acid-works, leaves a residue, called 'cinder', which is of some interest. A pile containing 60,000 tons lies at the works of the Mountain Copper Co., near Martinez; it has been leached with water to recover that part of the copper which exists in the soluble form, that is, as sulphate, formed during roasting. An average analysis of this leached material shows:

	%
Copper	0.45
Sulphur	1.86
Silica	3.85
Iron	63.37
Zinc	1.59

It contains also, 0.02 oz. gold and 0.9 oz. silver per ton.

Pyritic Cinder. The proper disposal of this accumulation presents some pretty metallurgical problems. In other countries there would be no difficulty in disposing of it profitably, but conditions in California are such as to make it almost a waste product. Pyritic cinder else-

where is smelted direct into pig-iron, as it constitutes a rich iron ore, in which respect the Hornet cinder is as good as any. The fine-grained condition and the high content of sulphur, however, render it of less value than ordinary run-of-mine ore, and it is generally used in small proportion along with coarse ore, in making a comparatively cheap iron, suitable mainly for purposes where strength is not particularly demanded. But even this use is denied it in this State, since we have no furnaces for smelting it. It may also be used as flux in smelting more silicious copper and lead ores, and some Mountain Copper cinder has been shipped for that purpose as far as Salt Lake City, although one cannot imagine much profit accruing to the purchasers. It is



useless to the smelters in Shasta county, since they are over-stocked with basic material, and need silica rather than iron. Similar material is treated in large quantities in Europe by processes designed first to extract the gold, silver, and copper, after which the oxide of iron left (and in that condition called 'blue billy') is run down in the iron-furnace. The experience of years has led the metallurgists of Europe to prefer the so-called Longmaid-Henderson process for extracting the gold, silver, and copper, since by it, with some additions, all three metals may be won in satisfactory proportion. It consists, briefly, in calcining the cinder with from 10 to 20% of common salt, for several hours (5 to 10) whereby the silver and copper are converted, the first wholly, the latter partly, into chlorides, which are soluble in brine, and still more so in a solution obtained by catching the evolved gases in a 'tower', they containing sulphuric acid, sulphurous acid, chlorine, and hydrochloric acid, and adding the acid waters to the calcined material, when some insoluble copper compounds, such as cupric chloride and oxide, are also taken up, as well as the gold and silver. The two precious metals are precipitated by means of zinc iodide and free iodine, and then separated by filtration. The copper is precipitated by iron scrap, or preferably by sponge-iron, and is collected as cement copper. This process has been in use for more than 50 years, and has added greatly to the world's store of metals. It might be initiated profitably here if a market could be found for the final residue of iron, which constitutes an important source of revenue in England, where the process has its largest scope.

Other processes have been suggested for the treatment of pyritic cinder, among them is lixiviation with sulphuric acid. This, however, does not dissolve the silver or the gold, which therefore are lost. Neither will the dilute acid attack the sulphide of copper, a little of which always remains after calcination, and this too is lost. It should be borne in mind that the result of calcining copper-bearing sulphides in general is to convert a part of the copper into the sulphate, another part into oxide through the decomposition of some of the sulphate, while, as just remarked, still another portion retains its original form of sulphide. An analysis shows that of 100 parts of copper in a certain ore that had been calcined for making vitriol, 54 parts existed as sulphate (and therefore soluble in water), 38 parts as oxide (soluble in weak sulphuric acid), and 8 parts as sulphide (soluble only in nitric acid). By skilful manipulation

the parts soluble in water can be much increased; but such manipulation is not practicable in kiln roasting, nor generally when the ores are being calcined for their sulphur content.

MAKING ACID. The problem of the proper treatment of pyritic cinder must give way to the more important one of the treatment of the raw sulphide as it comes from the mine. Assuming, which is true, that the heavy pyrite, such as we are now considering, is valuable mainly from its content of sulphur, and that it does not carry enough of copper, gold, and silver to pay for their extraction solely, the question is what process should be employed to render them as well as the sulphur simultaneously available for the market. The answer is not far to seek. At Ducktown, in Tennessee, a large copper smelter has attached to it the largest sulphuric acid plant in the world, capable of making 1000 tons of 60° acid in a day. The smelting method is the pyritic, the same process that has given Shasta county its eminence in copper production. The ore, like those of Shasta, carries about 3% copper, but without gold or silver. It averages 30% in sulphur, which, in the course of smelting, is discharged from the furnaces in the form of sulphur di-oxide, as elsewhere, but instead of being allowed to pass into the atmosphere the fume is conducted into lead chambers and converted into acid. The process, of course, is practicable wherever sulphide ores exist, and it is applied successfully, for example, both at Trail, Anaconda, and Douglas.* The method differs from that commonly pursued only in the manner of getting the di-oxide; for the ordinary way is to roast the pyrite in a kiln or mechanical furnace, without smelting the ore. In this case a residue of iron oxide is left. At Ducktown the residue is smelted into slag and matte, the latter containing the copper. Did the ores there carry gold and silver, these two would go into the matte and be saved. It will be seen that the sulphuric acid process supplements the smelting operation beautifully, not only by suppressing the fume, which, as we shall see, has been a great drawback to metallurgical projects, but absolutely turning into money what was formerly a nuisance.

* While this method is applicable to the conditions existing in California, there are many economic considerations to be reckoned with. Although these deposits are at a distance of 300 miles from the acid works, such are the facilities for mining, and so low the freight-rates, that the ore is delivered to the burners in or near San Francisco at a cost that will meet the competition of nearer 'sulphur ore', of as good character. The pre-war price averaged about $5 per ton delivered for an ore carrying from 45 to 48% sulphur. These facts are significant in their relation to the mining industry of Shasta.

Working on a scale of 100 tons of pyrite daily, equivalent to the production of about 120 tons of 66° acid, the cost of crushing and calcining the ore would reach, in a well arranged and well conducted plant, about $1 per ton, if mechanical furnaces were used, while it might be done for a little less if kilns were employed. To this amount the loss in valuable metals must be added in order to obtain an idea as to the relative advantages of the methods. This loss is the sum of the values of the copper and precious metals, less the customary losses in smelting, which might be 2 or 3% of the gold, 4 or 5% of the silver, and one-third of the copper. The last item is large, because ore of low tenor loses proportionally more than the high-grade. The actual yield of copper from an ore carrying 1.5% copper would not exceed 22 lb. per ton, which, being in the form of matte, would have to be re-smelted and refined, and submitted to deductions, so that with the gold and silver (say $1.60) added, the net yield would be about $3 per ton. But vast quantities of sulphide ore of hardly higher grade than this have been smelted in Shasta county at a profit. The average charge to the furnace contains but 3% copper, with an average of 90c. in gold, and 1.25 oz. of silver; but because it contains an average of 4% zinc it is more difficult to smelt than the comparatively pure pyrite of which we are now speaking. These ores require silicious flux to the extent of about one-fourth of the charge; and while richer quartz is desired for this purpose, the smelters have to take large quantities of vein-quartz that may carry no more than a dollar or two per ton. A certain property has delivered to a Shasta county smelter within the past year several thousand tons of quartz assaying only $2.50 per ton in gold and silver, and has achieved a profit after mining, transporting, and paying treatment-charges upon it. It is a wonder that it can be done at all, in view of the high cost of coke and labor.

Not only have the quartz mines of Shasta county been put under contribution for supplies of acid flux, but silicious ores in considerable quantity have been imported from distant regions. These ores, however, are of much higher tenor and have to bear much heavier freight-charges. On the other hand, much basic ore, the ordinary mixed sulphides of the district, has been exported to points so distant as Salt Lake. This shuffling about of ores of different characters according to the exigencies of the metallurgical process is one of the most interesting characteristics of modern practice, and illustrates better than anything else the special advantages of smelting methods. The Mountain Copper Co. has the distinction of being the first to adopt thorough methods of mitigating the fume evil, and of utilizing to the utmost the sulphur content of Shasta ores. Its complete plant at Bull's Head, near Martinez, in Contra Costa county, California, was designed not only to manufacture sulphuric acid from the fumes of smelting and roasting furnaces, but to convert the acid to industrial uses, through the manufacture of a fertilizer, familiar to agriculturists under the name of Mococo, the base of which is superphosphate of lime. The process consists in roasting the ore, receiving the smoke therefrom in suitable apparatus, by which it is made into acid, and then treating pulverized native lime phosphate with it, by which a portion of the phosphoric acid is set free, but still left in ad-

*'Calumet & Arizona Sulphuric Acid Plant', by Courtenay De Kalb. M. & S. P., March 30, 1918.

mixture with the calcium sulphate concidently formed. The addition of substances containing potassium and assimilable nitrogen converts the super phosphate into what is styled a 'complete fertilizer.' The scarcity of native phosphates in this State compels the company to go as far afield as Idaho, where it has acquired deposits, and whence it draws large supplies.

The accompanying photographs show the extent of plant necessary, with wharf facilities, slag dumps, and the smokestack, which is 225 ft. high and is constructed of reinforced concrete. An interesting item is the old steel iron stack, in its crumpled condition, resulting from the action of sulphur gases through a series of years.

Memories of the Afterthought. This mine, 20 miles north east of Redding, ever since its discovery by C. M. Peck in 1872, has been one of the most noted mines in the State, not by reason of its magnitude, for there are many larger, nor for its production, for there are many more productive, but chiefly because there is always something doing at the Afterthought something novel in a metallurgical way. It has been the scene of numerous experiments, chiefly on account of the refractory character of the ore, which consists of a mixture of chalcopyrite, pyrite, blende, and barite, with some of the usual derivatives of the country-rock, and is therefore similar to that of other deposits in the base metal range. The contents in gold, silver, and copper are sufficiently generous to encourage extensive mining operations, which have not done so well. The earliest attempt to reduce the Afterthought ore took place soon after the discovery, when a 10-stamp silver-mill was erected. Success was not achieved, owing to the scarcity of oxidized material, which, however, seems to have been of good grade. Roasting was soon tried, but apparently without success, since the unusual step was taken of smelting the roasted and also the naturally oxidized material in a reverberatory furnace, using wood as fuel. This was a commendable step, resting on good metallurgical precedents, and, given sufficient skill and experience, it should have succeeded. It is true, wood is not a good fuel for reverberatory smelting, being surpassed by bituminous coal, and far surpassed by petroleum and producer gas, but the reverberatory furnace is superior to the blast-furnace in treating zinky ores, and especially those containing barite, as at the Afterthought. At that time wood was being used on a large scale in the reverberatories at Black Hawk, in Colorado, whence, no doubt, the local practice was derived. The settlement of Afterthought is embedded in a sea of trees, mainly fir and pine, whose wood, when seasoned, heats the furnace to the smelting temperature with fair readiness, but they are consumed with rapidity, it having required nearly a cord of dry fir to smelt a ton of ore in the old and ill-designed reverberatories at Butte. A furnace of modern design would use hardly more than one-third that, and might therefore perform its work with an economy comparable with that of the oil-burning [now powdered coal] furnaces at Ely, or those at Butte, which are heated by powdered coal. It is a great pity that this well-meant attempt was not continued, for although the abundant zinc in the Afterthought ore would have proved a serious obstacle, this method even now is far preferable, under the circumstances, to the blast furnace process that succeeded it. The first blast furnace, I am told, was put up to use lead as a collector—a seemingly incredible thing in view of the presence of ample amounts of copper sulphide in the ore, but not incredible when we consider the condition of metallurgy in that day, when common opinion held that lead, and lead alone, could extract the precious metals. This erroneous view was widely held, and prevailed for many years thereafter. Some unimportant deposits of galena in the neighborhood may have instigated the attempt, which came to nothing, and not long after a larger cupola furnace was erected, the locality becoming known as Furnaceville. Some ore was shipped to Swansea, it is said, and the respectable sum of $450,000 was reported to have been received for it, the total sales having been 11,000 tons. Various spasms of activity followed, and three or four other furnaces were set up, of which sundry relics survive.

It was my fortune to have examined this district over 20 years ago. Samples were taken from every working breast and from the small heaps of roasted ore scattered on the hillside. The property was in the hands of Joseph Enright, widely known as the builder of traction engines, of the Shasta county lumber-flume, and of the Anderson-Bella Vista railroad. The assays will show the character of the ore handled during those early years.

	Gold	Silver	Copper
	Oz.	Oz.	%
Average of main dump	trace	9.64	5.2
Other samples, No. 1	0.04	32.16	...
No. 2	trace	5.1	10.8
No. 3	trace	2.2	12.0
No. 4	trace	5.44	7.0
No. 5	trace	9.64	5.2
No. 6	trace	40.15	6.0

From similar ores the first smelter produced three carloads of matte, which was sold in San Francisco. The three carloads assayed from 0.33 to 0.92 oz. gold, 72 to 83 oz. silver, and from 49 to 60% copper. It is interesting to know that the railway charges were $7 per ton, the treatment charge $20.50, that the gold brought $20 per ounce, the silver 95% of the New York quotation, and that the whole shipment, amounting to 54 tons, the sum of $5757 was received. These terms compare well with the present, excepting that the treatment-charge has been reduced to $3 or $4 per ton.

After many efforts the managers came reluctantly to the conclusion that the zinc content was too high to admit of smelting by either the pyritic process as later practised, or the roasting-smelting method as carried on at first. The comparatively high-grade material had been measurably exhausted, but, development continuing, they had to face the problem of reducing ore carrying 2.8% copper, 11.6% iron, 15% zinc, 18% sulphur, 11% silica, 7.4% barite, and 5.6% alumina, with $4 to $5 in precious metals. Of this material immense quantities exist and are well opened up, and provided with a

railway one mile long for transport to the site of the works, which is upon the left bank of Cow creek, and upon a steep side hill. A little calculation will show that rather more than half the ore consists of sulphides, and that serious obstacles to reduction exist. This being the case, it is not surprising that much experiment and research have been given to other processes, in the hope that some way would be found to overcome the various difficulties. It is apparent, at once, that no method of dressing would be applicable, since the concentration could not extend beyond the removal of the gangue, which constitutes less than half the weight whereby a ton of product would be obtained from two tons or less of ore. The enriched product, therefore, could not contain more than 6% of copper, with six or eight dollars in gold and silver, and might not pay either to ship or to smelt. The zinc having previously been a waste product, its recovery in commercial form became a matter of great interest and absorbed the attention of the operators, in view of the fact that the mine contains many millions of dollars worth of that metal, whose presence makes the associated metals valueless. Herbert Haas, formerly metallurgist to the company, and introducer of the pyritic method there, after prolonged study, gave his opinion in the following words: "All attempts at concentration failed, the ore being a very intimate mixture of blende and pyrite, which resisted electro-static and magnetic concentration. Hand-picking and wet concentration were equally unsuccessful, for even the finest particles showed the intimacy of the blending. It was noted that the zinc concentrate contained more of the copper and silver of the original ore than the pyrite concentrate held, while the latter could never be obtained even reasonably free from blende." Mr. Haas at that time looked forward to a chemical separation of the zinc, prior to smelting the residue for its copper, gold, and silver. Other tests followed, and various processes for extracting the zinc were suggested, but nothing came of it beyond the co-ordination of ideas, and the mine laid practically idle until taken over by the present company, styled the Afterthought Copper Mining Co., composed of Eastern people, who, supplied with ample funds, are now carrying on a prodigious experiment in flotation, which is attracting great attention, both from the novelty of its principles, and from the costliness of its plant. The method is a form of selective flotation, in which it is designed to form three products, two of which, the zinc concentrate and the copper concentrate, are valuable, the other, the waste, valueless, by means of two successive applications. The plant has a daily capacity of 300 tons of ore, and has cost to date more than $500,000. The work is interesting indeed, and merits a full description.†

Some special characteristics of the Afterthought property demand notice. The distance to the railway is 13 miles, the wagon-road is far from good, and connection is made with the main line of the Southern Pacific railway by means of a branch line. These artificial disadvantages are offset by certain natural advantages, among which are the propinquity of fuel supplies—wood and coal—of water, and incidentally of a flume, which, passing immediately in front of the works, enables timbers and sawed lumber to be delivered at low rates and in large quantities. To this may be added the advantage of cheap and abundant supplies of electricity from power-plants not far away.

An important feature of the treatment at Ingot (as the mill-site is called) consists in roasting and then smelting the copper concentrate, which is deemed too low-grade to stand the cost of shipment. The smelting process is to be carried out in a reverberatory furnace, patterned after those used at Garfield, Butte, Ely, and other copper-smelting centres. It is 60 ft. in length of hearth by 18 ft. in width. Such a furnace should smelt about 250 tons daily of an average charge, and so will prove ample for all probable requirements. The fuel is to be petroleum, which will cost about $3 per barrel, and one barrel or a little less should smelt a ton of charge. Oil, of course, is a convenient and effective fuel, which every furnace-superintendent likes to use, but it is pertinent to inquire if, considering the abundance of other fuels at that point, a cheaper one could not be used. By the aid of the flume, which is right at hand and no more than 100 ft. from the furnace, an ample supply of good wood can be secured, at a cost probably much below that of an equivalent amount of oil. A cord of wood is worth two barrels of oil, but the cost of firing is greater. Direct firing with wood may not answer on so large a furnace, but if not, then it may be converted into gas by means of a producer, with results as good as oil can give. The apparatus might be less convenient, but economy and not the convenience of operators is the object. Producer-gas from resinous woods can be made to contain 125 to 135 heat-units per cubic foot, thereby equalling that made from coal. It would seem that if there were a really favorable opportunity to make use of the gas-producer it is at Ingot; for not only is wood found there in immense quantities, but there is a coal mine within a few miles, which should have a great influence on the metallurgy of the local ores.

[See illustrations on pp. 59 and 60]

Cost of producing silver at the Nipissing mine at Cobalt, Ontario, is as follows, according to the annual report:

	Per ton	Per oz., cents		Per ton	Per oz., cents
Exploration	$1.329	2.92	General, legal	$0.159	0.35
Drifting	0.246	0.54	High grade mill	1.778	3.91
Development	0.897	1.97	Low grade mill	5.037	11.08
Stoping	1.282	2.82	Depreciation	0.725	1.59
Hoisting, dump	0.082	0.18	Marketing	0.826	1.82
Shipping, reside etc.	0.041	0.09	Corporation, etc.	0.254	0.56
Assaying, cle	0.122	0.27	Total	$18.128	39.87
Management	0.525	1.15	Less sundries	0.387	0.85
Coal	0.112	0.25			
Insurance, taxes	4.713	10.37	Net cost	$17.741	39.02

The total cost of production was 35.75% of the gross value of the output.

Development of vein 109 in the Nipissing has opened a long shoot of 3000-oz. ore, adding considerably to the ore-reserves.

†Which will be published in this paper shortly.—Editor

Oxy-Acetylene Welding of Large Cylinders

By L. M. MALCHER

One of the big steel rolling mill engines at the Farrell works of the Carnegie Steel Co., at Farrell, Pennsylvania, that had been doing its full share in helping to win the War broke down two weeks after the signing of the Armistice, having worked constantly up to then on 100% war orders. In the accident, besides other parts, the left-hand low-pressure steam-cylinder, 70 in. inside diameter, of an Allis-Chalmers twin-tandem compound-reversing engine was badly fractured, in consequence of the breaking of a connecting rod at the moment of reversal.

A serious situation confronted the officials of the Carnegie Steel Co., as it would have taken at least three to three and a half months to obtain a new cylinder, in case the broken one could not be repaired in a shorter time: 360 men were thrown out of employment. The broken cylinder was of such size and the damage done was of such character that a decision whether the cylinder was to be renewed or repaired involved a risk on the part of the management. Although considerations of expense as between the cost of purchasing a new cylinder and repairing the old one were of secondary importance, the cost of repairing was estimated to be about one-third that of a new cylinder.

The officials of the company, after careful investigation, decided in favor of oxy-acetylene welding. They called upon the job-welding shop of the Oxweld Acetylene Co., at Chicago, to meet the emergency. Three expert welders, accompanied by all the necessary equipment, went immediately to Farrell and completed the job under my direction. The total time consumed in repairing the low-pressure cylinder, including chipping, pre-heating, and welding, was 72 hours. While dismantling the engine, a fracture was discovered in the right-hand, 42 in. diam., high-pressure cylinder. This fracture also was repaired in about 18 hours. It took just seven days, from the time the order was given to complete the entire job.

The data covering this work are given in detail below:

Low-Pressure Steam-Cylinder

5000 hp. Allis-Chalmers twin-compound reversing engine. The horsepower given is the maximum developed while rolling and running at about 100 to 110 r.p.m.

Cylinder bore	5 ft. 10 in.
Stroke	4 ft. 6 in.
Weight of cylinder	13 tons
Thickness of iron casting	2¾ to 3⅝ in.
Number of cracks (See Fig. 1)	7
Total length of all cracks	22 ft. 2 in.
Preparing and pre-heating casting	27 hours
Welding casting	45 hours
Linde oxygen consumed	2850 cu. ft.
Prest-O-Lite acetylene consumed	2845 cu. ft.
Oxweld cast-iron welding rods	390 lb.
Oxweld 'Ferro' flux	25 lb.
Number of welders	3
Period of welding shifts	10 and 30 min.

High-Pressure Steam-Cylinder

5000 hp. Allis-Chalmers twin-compound reversing engine.

Cylinder bore	3 ft. 6 in.
Stroke	4 ft. 6 in.
Weight of cylinder	5 tons
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
Linde oxygen consumed	650 cu. ft.
[illegible]	[illegible]
[illegible]	[illegible]
Oxweld 'Ferro' flux	10 lb.
[illegible]	[illegible]
Period of welding shifts	10 and 30 min.

While welding inside the cylinder castings, the men relieved one another every 10 minutes because of the extreme heat deflected back on them during the operation. On the outside welding, however, the heat was not so intense and the men relieved one another every 30 minutes.

After the engine-cylinders were machined, it was almost impossible to determine where the cracks had been. The total cost of this repair represents but a small fraction of the replacement cost, but even this saving is insignificant when compared with the disorganization that would have resulted from the laying off of a large body of trained workmen and with the enormous loss that would have been entailed in a stoppage of production.

[See illustrations on pp. 61 and 62]

Recovery of Zinc From Ores

Zinc recovered from sulphide ores in Utah and adjacent States is mostly from mixtures of lead and zinc sulphides. The usual milling treatment for such ores is to crush, size, and classify the ores, and then separate as cleanly as possible the gangue from the sulphides with jigs and tables. By this separation of a mixed sulphide ore, a lead product and a zinc product are obtained. Sometimes the lead contains as much as 10% zinc, or even more, and the zinc contains a considerable quantity of lead. The zinc that accompanies any lead ore sent to the lead smelter is not recovered. Therefore the problems connected with the milling of a zinc sulphide ore are as follows: (1) effecting a better separation of the lead and zinc materials; and (2) preventing losses of zinc or of lead and zinc in the tailing.

If an ore cannot be rendered marketable by concentration processes the next step is to devise a process for treating the ore locally, that is, near where the ore is mined, so as to do away with the costs connected with transporting the ore and the subsequent smelting of it. In general, if an ore cannot be treated at a profit by a smelting process a hydro-metallurgical process is devised. Hydro-metallurgical treatment of zinc sulphide ores has been proposed in many different forms during the past half century, but has in general failed to be adopted, on account of the peculiar chemical properties of zinc and the low value of the products that can be made. Zinc requires more chemical or electrical energy, in comparison with its value after recovery, than almost any other major metal on the market; and the high consumption of chemicals or of electric energy involved in its recovery has usually made hydro-metallurgical processes of questionable value.—D. A. Lyon and O. C. Ralston in Bulletin 168 of U. S. Bureau of Mines.

Briquetting Magnetite Concentrate

By F. H. MASON

It is becoming generally accepted that the establishment of an iron and steel industry is exceedingly desirable if not absolutely essential to the well-being of other industries that were established during the War on the northern Pacific Coast. The difficulty, however, has been that, while there appears to be plenty of both coal and iron available, most of the iron ores are of the magnetite variety, which are not by themselves suitable for smelting in the blast-furnace. The British Columbian government, realizing this, employed Alfred Stansfield, professor of metallurgy at McGill University, to investigate conditions and make a report on the feasibility of smelting British Columbian magnetite in an electric furnace. While Mr. Stansfield's report has left things pretty much in *statu quo*, the perusal of it reminded me of some experiments that I made over twenty years ago on the magnetic sand that occurs at a number of points along the coast of Quebec and Labrador, and it struck me that the final result of these experiments might be of assistance in evolving a plan for the smelting of magnetite in the North-West.

This magnetic sand was composed principally of magnetite mixed with ilmenite, garnet, and silica, and it was found that by magnetic concentration they could be enriched up to about 66% of iron. The difficulty, however, was the briquetting of the concentrate into a form sufficiently solid to stand the burden of other ores in the blast-furnace without crumbling, for the idea at the time was to smelt them together with the hematites and limonites that occur in Nova Scotia, and any metallurgist will realize the danger of introducing structurally weak briquettes into the blast-furnace. It occurred to a client of mine, whose name, if I remember rightly, was Armstrong, that the difficulty might be overcome by mixing the concentrate with a strongly caking coal in a coarsely powdered form and coking the coal, thus embodying the concentrate within the coke. In carrying out this idea I selected washed coal from the Intercolonial Coal Co.'s Drummond mine, at Westville, Nova Scotia, which was about the most strongly caking coal in the Province. It produced a remarkably tough coke. This I mixed in varying quantity with the concentrate and coked it in the crucible of a wind-furnace, the object being to find the least quantity of coal that could be used and still produce a strong coke. I found that with Drummond coal it was possible to use as much as two and a half parts by weight of concentrate to one part of powdered coal and obtain a ferruginous coke that would be capable of bearing the burden of other ores in a blast-furnace. The crucible was allowed to remain in a reducing atmosphere in the furnace for some time after the hydro-carbon gases had been burned off, and this undoubtedly reduced some of the magnetite to metallic iron, and contributed toward the strength of the resulting coke.

Having apparently solved the problem, we found to our chagrin that someone else had thought the scheme out ahead of us and patented it. The Wabana mine on Belle island, Newfoundland, was being opened up at this time, and, soon after, ore from it was being put on board ship for 29 cents per ton, so interest in Labrador sand flagged, and the matter was allowed to drop.

Looking at those experiments in connection with the treatment of magnetites on this Coast, they have an entirely new significance. For his report the British Columbian Department of Mines provided Mr. Stansfield with the information that there would be no difficulty in providing 50,000 tons per year of magnetite running 50 to 55% of metallic iron. If it were possible by crushing and magnetic concentration to increase the iron content of such ore to between 65 and 70% without serious loss in the tailing, the decreased quantity of material to be smelted would go a long way toward covering the cost of crushing and concentration, if it did not entirely do so, and the magnetite would be in exactly the right form to mix with powdered coal. To prevent the magnetite by reason of its greater density from becoming separated from the coal and falling to the bottom while being charged into the coke-ovens, probably it would be necessary to add sufficient tar or crude oil or other binder to make the whole sticky.

During the process of coking, the magnetite would be in an incandescent state and in intimate contact with hydro-carbon gases and coke produced from the coal, and thus undoubtedly would be reduced wholly to spongy iron. While the coke and iron sponge was being projected from the ovens and quenched in the usual way, a portion of the iron sponge would become re-oxidized, but this oxide, of course, would be reduced again easily in subsequent operations. The product thus obtained would consist of carbon, spongy iron, and any impurities contained in the original concentrate and coal, and it could be melted in the blast-furnace or by other means.

The foregoing is offered, of course, only as a nucleus from which by experimenting a process may be evolved. The patents must have lapsed before this, so the idea, such as it is, is at the disposal of the metallurgical profession.

ZINC SULPHIDE resists most ordinary solvents, not being dissolved with sufficient rapidity by any of the commercial acids, hence requires roasting before the majority of the proposed hydro-metallurgical processes can be applied. Sulphide of zinc is one of the most refractory sulphides to roast, on that account the cost of zinc roasting is higher than that for any other major metal. In order to get the zinc into solution after roasting, it may be converted into a sulphate or a sulphide, or hydrochloric acid may be used as a solvent for the leaching of zinc sulphide ores in localities having industrial plants where acid is a useless by-product. Hydro-fluosilicic acid is also recommended [it is used at Trail, B. C.] as being a desirable solvent for roasted zinc ores, on account of the ease of precipitating zinc from solutions by electrolytic methods.—D. A. Lyon and O. C. Ralston in Bulletin 168 of U. S. Bureau of Mines.

Progress in Methods of Exploration

By HUGH M. ROBERTS

Methods of mineral exploration in recent years have undergone developments that are on a par with those in other branches of the mining industry. This progress has not been so generally realized nor has it received so much attention as the refinements that have taken place in the art of fine grinding or the innovations in oil-flotation. While the decline of prospecting has been discussed continuously in mining periodicals, but few of these discussions have touched upon the modern practice of mineral exploration which has grown up in its place. The subject is important because the continuance of every mining enterprise is ultimately dependent upon the finding of new orebodies. The day has gone by when ore deposits were disclosed by the chance removal of turf or by the sinking of a shallow test-pit. These were the opportunities of a past generation. The restriction of these opportunities has led to a keen study of the principles of economic gelogy and the development of better practice in exploration.

In particular, it is the purpose of this article to trace the increasing effectiveness of the diamond-drill as an exploring instrument. Not only have there been mechanical improvements in the drilling process, such as the increased efficiency of drilling-engines, the introduction of special devices for recovering core as the double tube-core barrel and the invention of the Maas compass for the surveying of drill holes, but on the more strictly mining engineering side, new methods of securing accurate results in sampling have been devised by the combining of the assays of core and cuttings. Also, by the introduction of the core-splitter, it is now possible to preserve a complete uncrushed sample of ore for geological purposes without interfering with the accuracy of the analysis. A carefully taken diamond-drill sample is, thus, superior in accuracy, convenience and usefulness to any other type of ore-sample. The matter of differential selection in sampling is largely eliminated, for the diamond-bit cuts through everything in its path with rigorous impartiality; but a diamond-drill sample must be recovered by experienced drill-men who are capable of applying some degree of ingenuity to meet conditions. The design of an effectual sampling process to fit any particular set of conditions usually requires the science of the mining engineer in addition to the mechanical ingenuity of the drill-man. The nature of the rock-formations surrounding an orebody, as well as the character of the ore itself, is a determining factor in the choice of the size of bits, methods of core recovery, varieties of casing, and the means for the recovery of cuttings. As various types of oil-flotation are adapted to particular kinds of ore, so must drilling methods be varied for the particular conditions under which the gold ores, iron ores, copper ores, and coal are found to occur.

After all, even the sampling process must be preceded by the finding of an ore deposit. For unraveling problems of general geology and ore deposition, the diamond-drill is the weapon above all others. As the knife to the surgeon, it is useful for the revealing of facts and for the elimination of barren ground. It furnishes systematic geologic specimens which may be taken at any angle from any position underground or on surface. In the scope of its possible moves, the diamond-drill may be likened to a chessman which moves in any direction, and for any distance between 10 and 3000 ft., taking whatever lies in its path. An exploratory campaign is singularly like chess in that any possible move may be made at the beginning, but as the game grows, the facts point out and compel the subsequent positions. Used as a scout, that is, in the form of a light portable outfit, suitable for rapid shifting from place to place, the diamond-drill may be made an extension of the prospecting pick for the purpose of gathering rock specimens which will permit the working out of areal geology in drift-covered districts, and in areas where the wash of mountain streams has concealed the underlying formations; also, in regions where the productive horizons are covered unconformably by later flat-lying strata of no consequence.

By utilizing the diamond-drill, it is possible for a mining organization to test many properties that have been turned down by reason of insufficient evidence. It is possible to go one step beyond the ore 'in sight' and deal with the uncertainties of ore deposition in an effective but not costly manner. Thus, by actual initiative, the opportunities for developing valuable orebodies may be greatly increased and their discovery not be left merely to chance and sporadic efforts on the part of the visionary, or of accident in connection with old mine-workings.

One swallow does not make a summer, nor will one diamond-drill hole determine the grade and tonnage of an orebody. Neither will one moil-sample in a drift determine the grade and tonnage of an orebody. A sufficient number of holes must be drilled to furnish the facts for thorough going decisions on the basis of average results. The work must be carefully planned for the particular problem in hand.

In the speed and facility with which definite results can be obtained, diamond-drilling excels any other known method of getting the facts. The rock must be exceedingly tough or troublesome because of caving in which it is not possible to advance the bit 10 or 20 ft. per shift. By using several drills, it is possible to attack the prob-

lem from different sides simultaneously. Thus, true conceptions of the nature of the orebody may be speedily obtained and plans made at once for mining methods and metallurgical processes. As time is of the essence of a contract, so in many mining enterprises, time is the chief factor. The use of the diamond-drill makes it possible to get results while the irons are hot.

Again, the portability of the diamond-drill permits it to be taken into inaccessible country, in fact, anywhere that a canoe or mule can go. The machine can be taken to pieces and transported in small parts. The growing use of the gasoline engine for power, solves the problem of fuel in many desert regions. Ore deposits may be developed in advance of roads and railways. In the Pas region of northern Manitoba, the railroad is being projected into the ore-bearing district because diamond-drilling has shown the existence of large tonnage of copper-bearing sulphides.

The diamond-drill has perhaps attained its widest field of usefulness in the Lake Superior region. At present, in this district, nearly every large mine keeps at least one drill constantly at work in advance of development. The drill has played a prominent part in the discovery of the iron ore deposits of Michigan and Minnesota. As a means of working out the complicated synclinal structures of the Menominee, Marquette, and Vermilion ranges, where high-grade deposits of iron ore are found, the diamond-drill has been most useful. The dike-controlled orebodies of the Gogebic range have been searched in many instances by drilling. On the Mesabi, many mines would, no doubt, still be today merely cut-over cedar swamps were it not for the application of systematic drilling methods. The Cuyuna range was developed by drilling in connection with magnetic attractions that gave a clue to the presence of the iron formations, which occur beneath glacial drift.

The copper deposits of the amygdaloidal flows and conglomerate beds of Keeweenaw Point in northern Michigan have been successfully explored by long horizontal and deep angle holes sometimes extending for distances of 2000 to 3000 feet. Many of the large nickel-copper sulphide masses of the Sudbury region of Canada have been found by the use of the diamond-drill, and mine development is directed on the basis of systematic drilling. In the Porcupine district of northern Ontario, the soft serpentines and gold-quartz lodes are all carefully explored by the diamond-drill in advance of mine-workings. The positions of many of the narrow silver veins of Cobalt have been determined by drill-holes. Many of the deposits in the districts mentioned are concealed by Glacial drift and occur in connection with rocks of intricate geologic structure. For this reason, the direction of exploratory work has become specialized and has gradually devolved upon mining engineers and economic geologists who have given their whole attention to this branch of technology.

As an example of the efficacy of the diamond-drill in the exploration of the disseminated copper deposits, the [illegible] Co., is of particular interest in that it shows two results: the nature of the orebody was proved both quickly and accurately. As described by Ira B. Joralemon* the work began in the fall of 1911 and continued up to September, 1913. He says:

"The Calumet & Arizona Mining Co. developed the disseminated orebody on the New Cornelia property by diamond-drill holes and by test-pits. The probable ore-bearing ground was co-ordinated with east-west and north-south lines at 200-ft. intervals, and drill-holes were sunk at the intersections of co-ordinate lines. The drilling was done under contract by the E. J. Longyear Co., of Minneapolis, Minnesota. Sampling was under the direction of representatives of the Calumet & Arizona Mining Co. Drill-holes were sampled in 5-ft. sections. All of the flow of sludge was caught in barrels and settled. When the end of the 5-ft. section was reached the water in the barrels was decanted off and the sludge-sample was dried and quartered down to three or four pounds. The rods were pulled at least every 5 ft., and core-samples were taken at even 5-ft. intervals where possible. Both core and sludge samples were sent to the assay-office of the Calumet & Arizona Mining Co., at Bisbee, for analysis. Small portions of both core and sludge for every 5 ft. of drilling were kept for future reference in labeled tin boxes. Owing to the thoroughly fractured, uneven nature of the rock, the recovery of core was low, and neither core nor sludge samples alone were satisfactory. To obtain an accurate assay-value for the ore developed, the length of core for every 5-ft. advance was measured, and on the basis of this length of core the sludge and core assays were combined to give a final value which represented all the material removed from the hole during the 5-ft. advance. The E. J. Longyear Co. furnished a chart which greatly simplified the work of combining core and sludge samples. Up to September, 1913, when development work was stopped, 84 diamond-drill holes had been sunk, varying in depth from 200 to 1000 ft. The total footage of diamond-drilling was 23,097 ft. Nineteen drill holes were stopped in ore. In all, 77 test-pits were sunk, with a total footage of 3955 ft. Of this test-pitting, 3606 ft. were in carbonate ore, and 349 ft. in sulphide ore; 1059 ft. of test-pitting checked drill-holes in carbonate ore, 175 ft. checked drill-holes in sulphide ore, and 2721 ft. were in advance of drilling. The total amount of drifting in sulphide ore was 1513 ft. The combined sinking and raising on drill-holes in sulphide ore amounted to 317 ft. The sinking, drifting, and raising proved that the value of ore indicated by drilling was very accurate. The channel-samples of test-pits in carbonate ore averaged 0.005% lower than corresponding diamond-drill samples; the test-pits and raises in sulphide ore averaged 0.05% lower than corresponding diamond-drill samples; and the drifts in sulphide ore averaged 0.26% higher than the assay-value of blocks of ore through which the drifts were run, as indicated by drill-holes at the corners

*Ira B. Joralemon: 'Ajo Copper Mining District'; Trans. A. I. M. E., 1914, Vol. 49, pp. 593-609.

of the blocks. In making the ore estimate, diamond-drill samples were accepted wherever drilling was done, and channel-samples of test-pits were accepted where sinking was done in advance of drilling."

Later exploration in connection with this orebody has been done largely by diamond-drilling.

In many other mining districts throughout the world, the diamond-drill has been useful in the discovery of ore. However, it is not intended to multiply instances. Those which have already been cited are sufficient to show that the diamond-drill has developed into an exploring instrument of the utmost flexibility and precision, equally useful in the earliest stages of an exploration and in the final mathematical determination of grades and tonnage.

It is also not difficult to see that the decadence of surface prospecting is inevitably in line with the trend of the times, because the opportunities for getting results by primitive methods no longer exist. Modern methods of ore-finding by the use of the diamond-drill will take the place of surface prospecting in greater degree. The increasing hazards of the future must be met by handling exploratory ventures on a scale commensurate with other modern undertakings, nor should these projects be carried out with timidity. If great discoveries are to be made, exploring campaigns must not be tied to the apron-strings of operating mines but must reach out and cover new country. Surely the development of effective methods of work does not necessarily work a curtailment of initiative. On the contrary, this development should enhance that fearlessness which must always accompany the search for new mines.

Magnesite in Washington

Extensive deposits of magnesite in this State were discovered during 1916. They are in Stevens county, a few miles west of Valley, on the Great Northern railway, and 50 miles north-west of Spokane. The enclosing rocks are slate, schist, and quartzite, and represent the replacement of dolomite by magnesite, according to F. M. Handy. There are 12 known deposits beginning at a point 5 miles due west of Chewelah and running 10 miles nearly due south-west. Six of these deposits contain large bodies of good magnesite. The ore is quarried by open-cut methods.

MINE OF THE NORTHWEST MAGNESITE CO., WASHINGTON

The three principal operators are the American Mineral Production Co., the Northwest Magnesite Co., and the Valley Magnesite Co. These have spent large sums on development and equipment, the Northwest company alone spending $700,000 in erecting a plant at Chewelah. During 1918 the output from this company's mine was 80,432 tons of crude ore, mostly converted into dead-burned sintered magnesite used by the steel trade for refractory purposes. The monthly capacity of the plant is 10,000 tons of calcined magnesite. There are six 125 by 7½-ft. rotary kilns, grinding machinery, etc. The ore is of the crystalline variety, similar to the deposits in Austria, according to Roy N. Bishop, the manager.

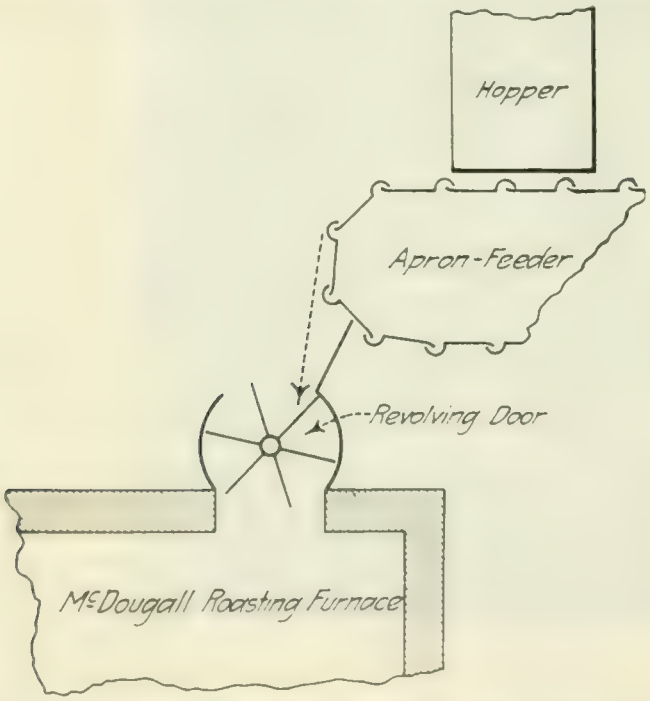
There is sufficient ore opened to supply the United States for many years.

Whether the property can operate successfully after the War will probably depend upon the attitude of the Government toward a tariff on this mineral, as the freight-rate from Washington to the Eastern seaboard at present is $16.50 per ton, compared with the pre-war ocean rate of $2 from Austria.

A Device for Excluding Excess Air From Roasting-Furnaces

STAFF CORRESPONDENCE

In the zinc-roasting department of the Anaconda reduction works, MacDougall furnaces, 20 ft. in diameter, are used to treat flotation concentrate carrying from 8 to 10% of moisture. The accompanying sketch gives an outline of the feeding equipment, in which an apron-feeder takes the material from the hopper and discharges



it directly into the furnace. Prior to the adoption of the present contrivance, the apron-feeder discharged into a covered chute, or hood, which was always giving trouble, as it extended from the top of the furnace to the apron, preventing proper observation of the latter. The hood also allowed excess air to enter the furnace, causing draft troubles elsewhere in the roasting-plant. With the device here shown, much of the excess air is excluded and an improvement in draft has been noticed; the apron-feeder is now accessible and exposed to view, so that its operation can be observed by the furnace-man.

The revolving door operates on the same principle as the door at a hotel entrance, from which, it is said, the idea was first obtained. As the apron-feeder travels, it discharges a panful of material at regular intervals onto the revolving door, the impact being sufficient to cause the door to spin around a half-turn or more, thus dropping the material into the furnace through the hole in the roof. The revolving door is enclosed on four sides by light steel plate suitably attached to convenient framing. In the sketch, the curved side-casing only is shown, the covers for the ends not appearing. As little clearance as possible is allowed for the door to revolve in its casing.

The present construction of the revolving door is as follows: a piece of 1½-in. pipe has six ribs welded onto it; vanes made of ⅜-in. plate, 2 ft. 6 in. long by 9 in. wide, are bolted onto the ribs, and a piece of 1⅜-in. shafting is inserted into the pipe. This shaft projects at both ends, and is made fast to suitable supports so that the pipe will turn on the shaft. As it is important that the revolving door may spin easily on the shaft, the latter is tapped for a grease-cup, which, when screwed down, forces lubricant between the shaft and the inside of the pipe. A cast-iron spider has been proposed as a better form of construction to carry the vanes, and will be adopted in the future.

Before actually trying this contrivance, it was anticipated that wet material would stick to the vanes till the door eventually clogged. This objection did not materialize, for the reason that the apparatus is kept hot and dry by being exposed to the gases inside the furnace. The originator of this clever device is George Lynn, machinist at the zinc-roaster.

Costs at the United Eastern

During 1918, this company, operating at Oatman, Arizona, produced 97,827 oz. of gold and 52,485 oz. of silver from 92,339 tons of ore, at a cost of $8.501 per ton and $8.02 per ounce of gold. The report of the general manager, J. A. Burgess, states that:

Mining costs were higher by 59 cents than in the year previous. This was caused by increases in power, labor, and supplies, amounting to 28 cents per ton; and by the increased amount of development done, which cost 50 cents per ton in excess of 1917. Decreased labor efficiency had a marked effect on costs, but it is difficult to give an accurate estimate of its importance in dollars and cents.

Milling costs increased 5 cents. This is more than accounted for by the increase in cost of labor and power, amounting to 8 cents per ton.

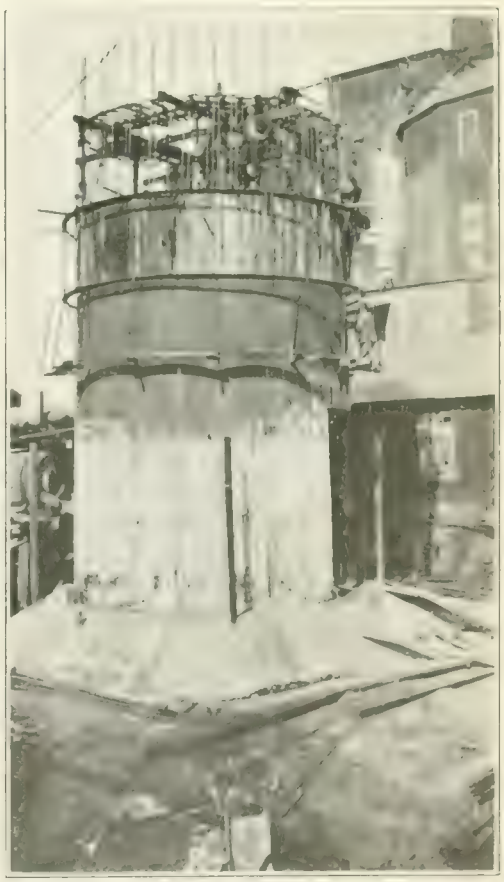
In indirect costs, the largest increase was in State taxes, which now amount to 69 cents per ton, an increase of 50 cents above last year's figure.

The principal adverse conditions that affected costs during 1918 were: (1) Increase in wages of approximately 10%, effective July 1, 1918; (2) increase in price of general supplies, approximately 10%; (3) increase in cost of electric power, 15½%, effective after May 1, 1918; (4) increase in State taxes, 300%; and (5) decrease in efficiency of labor.

The resultant of all cost variations was an increase of $1.39 per ton in operating costs, but the foregoing analysis shows that there would have been a decrease in costs for 1918, had conditions remained as they were in 1917.

GENERAL VIEW OF THE MOUNTAIN COPPER CO.'S PLANT AT MARTINEZ

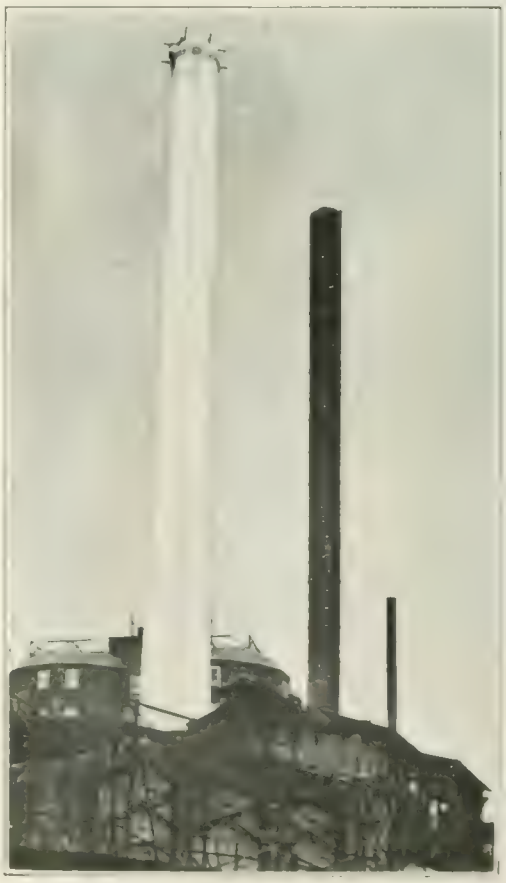
LOOKING DOWN UPON THE OLD STACK FROM THE TOP OF THE NEW ONE



THE NEW SMOKE-STACK DURING CONSTRUCTION

THE WHARF AT BULL'S HEAD, NEAR MARTINEZ

THE [illegible] OF THE OLD SMOKE-STACK



THE REINFORCED CONCRETE AND THE SHEET-IRON CHIMNEYS

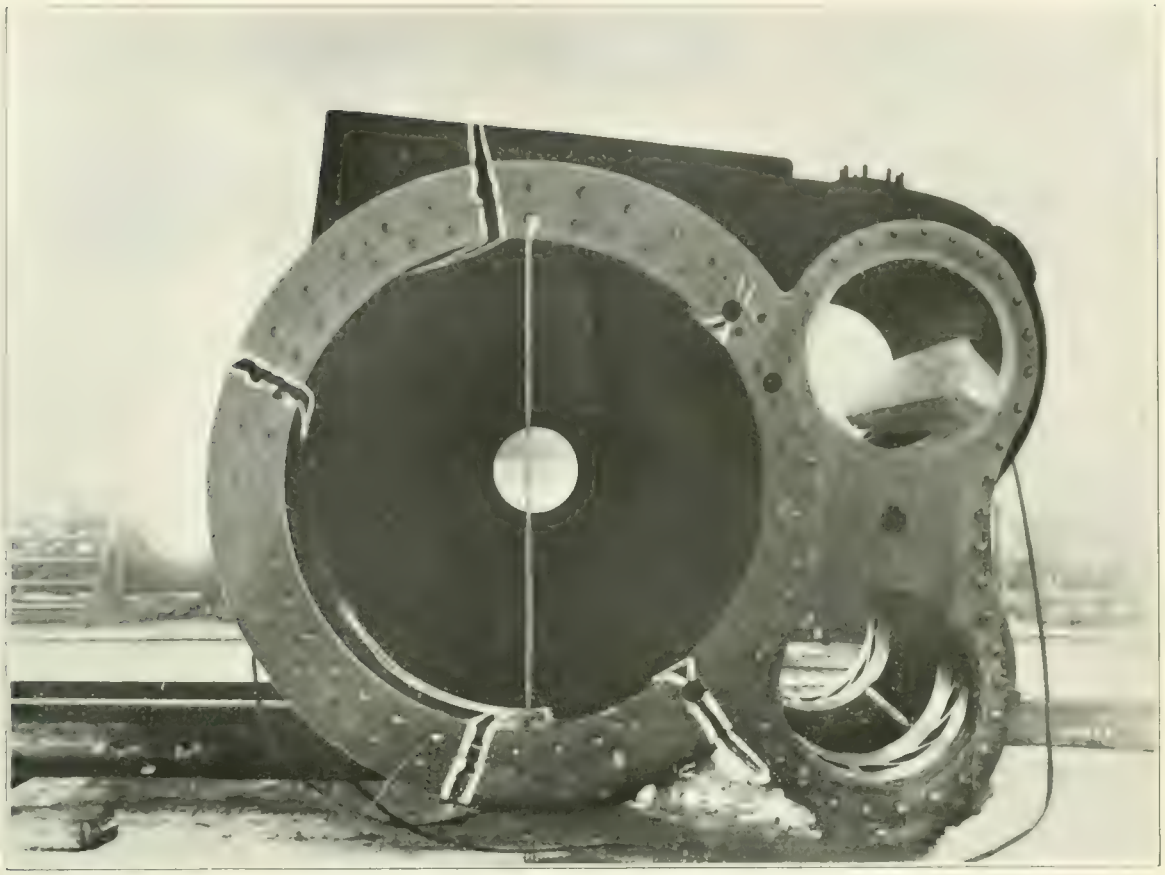


FIG. 1. WELDING WITH THE OXY-ACETYLENE FLAME: THE FRACTURED STEAM-CYLINDER

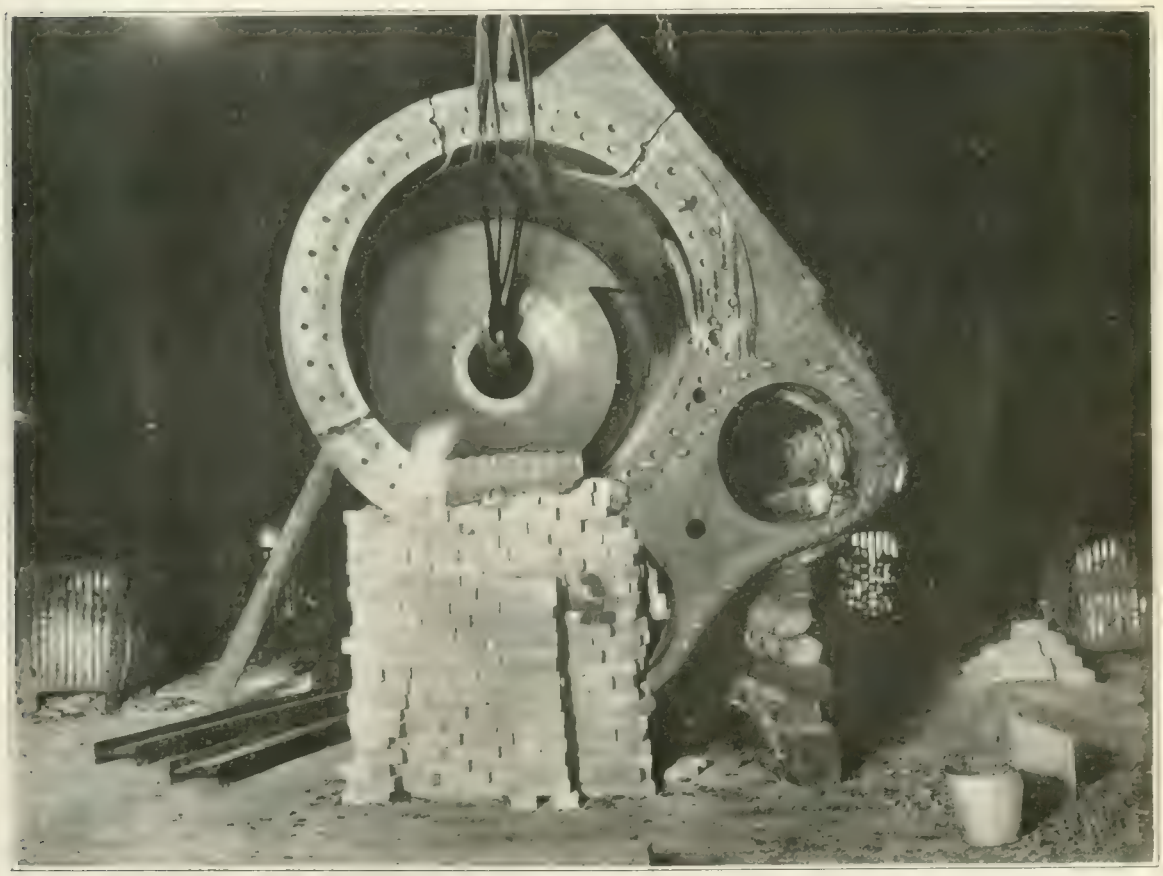


FIG. 2. THE WELDING

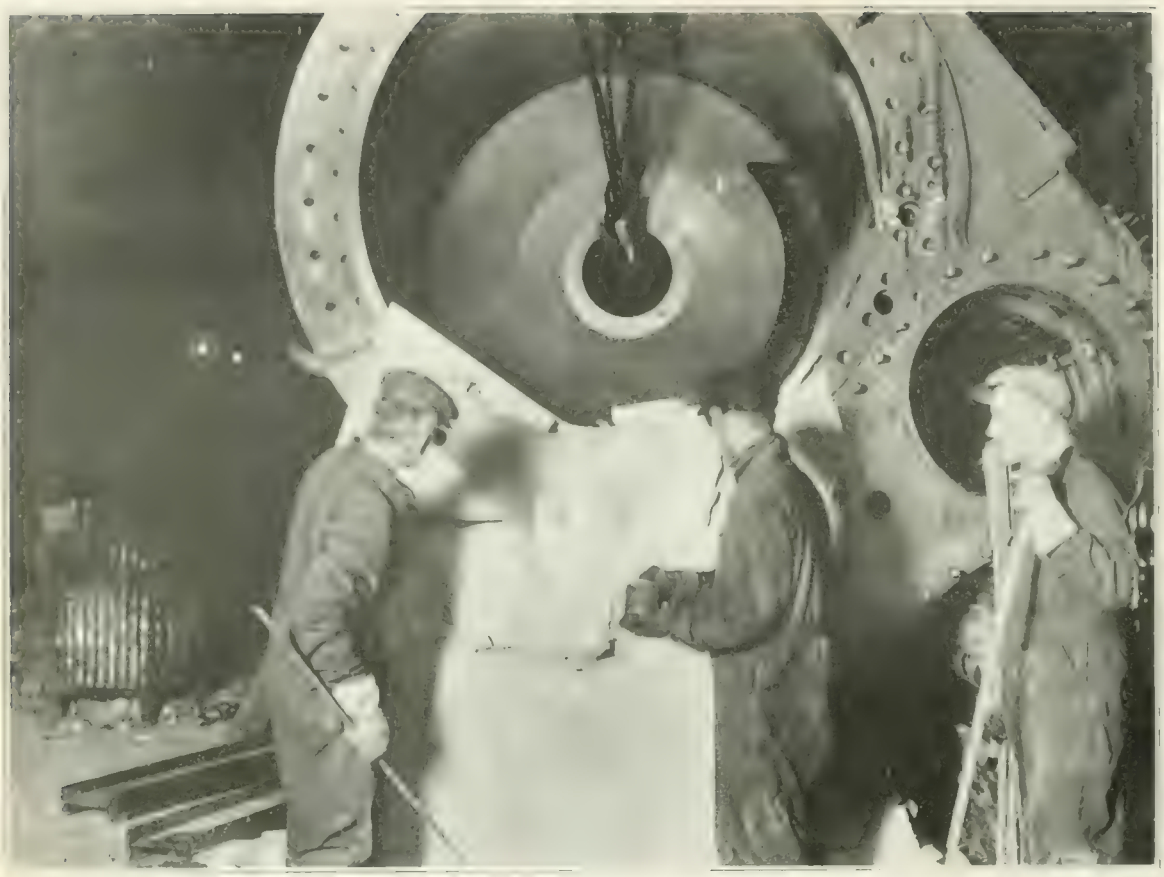


FIG. 3. A NEARER VIEW OF THE OPERATION

FIG. 4. THE RESULT

REVIEW OF MINING

ANCHORAGE, ALASKA

RAILROAD AND DEVELOPMENT PROGRESS.

A surveying party, under T. W. Secrist, has taken the field to continue location of the railway in the Broad Pass region. Rails are laid to Talkeetna, and grading is 85% completed from Talkeetna to Indian river. Progress is delayed by lack of funds, the filibuster in the last Congress having held up the appropriation. An emergency sum of $2,000,000 was asked of Congress by the Secretary of the Interior to continue work till the end of the fiscal year—June 30—when it is expected that an appropriation of $13,000,000 will be made sufficient to complete the road. This is $9,000,000 more than the original estimate. [As published in the 'Press' of June 14, the House voted for $1,964,350 to carry on the work.]

Considerable activity is indicated for the coming season. Many men are going to the hills to prospect, and companies holding claims upon which little was done during the War, are preparing to do exploratory work. The Willow Creek district will be especially active, with a number of new companies in the field.

Cache Creek will be stimulated by a wagon-road to be built from Talkeetna by the Alaska Road Commission, under jurisdiction of the War Department, if Congress grants the requested appropriation. The Cache Creek dredge will not operate this summer. T. D. Harris is on the ground superintending a change in the power system —from coal to hydro-electric.

M. A. Ellis of Seattle is operating a hydraulic plant on Cache creek.

Roads and trails are also planned from Talkeetna to the Iron Creek district; and the Broad Pass region, one of great possibilities, is being brought into more prominence as the railroad progresses. Completion of the line will see the beginning of a healthy development of the mineral resources of this large and promising region.

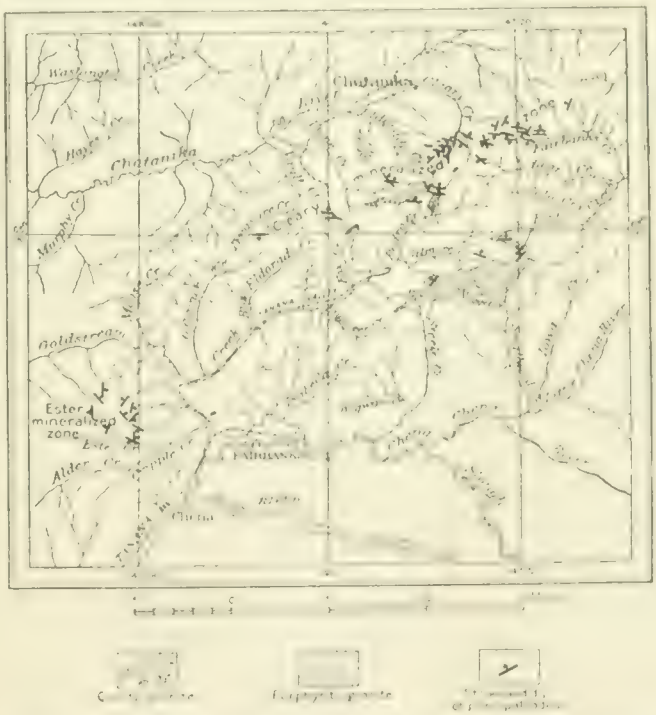
The discoverer, Joe Morris of Spokane, of the Le Roi mines at Rossland, British Columbia, in the late 'eighties, representing a company composed of himself, W. J. C. Wakefield, H. H. Boomer, A. Witherspoon, and W. A. Monroe, has commenced work on the Copper King and Talkeetna claims on Iron creek. They will do surface prospecting during the summer months, and propose to prospect the ground with a diamond-drill next winter.

William Martin of Seattle will continue to operate the mine and mill of the Alaska Free Gold Mining Co. in the Willow Creek district. The snowfall was exceptionally light during the past winter, and the season is two weeks earlier than usual on that account.

The Gold Bullion mill commenced operations on May 17. After many vicissitudes this property has been a marked success, largely due to competent management. N. D. Bothwell continues in charge.

W. F. Rock of Denver has taken over the Talkeetna claims, and will do 600 ft. of development. He will install a compressor and drills. Power will be derived from water.

The Mabel mine and mill has been sold to Loveland, Colorado, people. It will be known as the Loveland-Alaska Mining Co. Development is under way. A



THE FAIRBANKS DISTRICT, ALASKA, WHICH WILL BENEFIT GREATLY BY COMPLETION OF THE RAILWAY

cyanide plant to treat accumulated tailing is planned. H. M. Fickenger will manage the property.

A copper prospect on the west side of Cooks inlet, at Kamishak bay, will be explored this summer by Charles H. McNeil, who brought a large outfit, including horses, from Seattle, unloading at Seldovia. From Seldovia a small boat will transport the material across the inlet. Mr. McNeil was prospecting in this region when Mt. Katmai erupted in 1913. The ground was covered with ash, which lay on the snow and prevented its thawing during the entire summer. The party was in grave danger and suffered from sulphurous fumes and volcanic dust and lack of air.

James Girdwood will employ 60 men at the Crow Creek placer mine in the Turnagain Arm district. The mine did not operate in 1917, due to disturbed economic conditions.

The Hope district promises unusual activity in both quartz and placer mining.

An interesting prospect is being developed at Bird point on Turnagain arm, where a gold-bearing vein is exposed at low tide. A coffer-dam was constructed, and a shaft sunk on the vein to a depth of 45 ft., when an unusually high tide, accompanied by heavy ice-floes, took the dam out and flooded the shaft. An incline was then started above the high-tide level, and cut the vein at a depth of 80 ft., where it is 12 to 18 in. wide and shows good gold content.

DIVIDE, NEVADA

NAMES OF INCORPORATED COMPANIES.

The following list contains the companies incorporated to operate at Divide, and includes the principal properties in the district. Nearly all of them were registered during 1919, in the State of Nevada. The Belcher was formed in 1916, the Brougher in 1918, the East Divide in 1918, the Gold Reef in 1908, the Gold Reef and Gold Wedge in 1918, the Midway in 1912, the Nevada in 1917, the Tonopah Divide in 1912, and the Tonopah Hasbrouck in 1918.

Name of company	Claims	Number of shares	Par value
Apex Divide Mining	4	1,500,000	$0 10
Allied Divide Mining	1	"	0.10
Alto Divide Mining	3	"	
Apex Divide Mining	13	"	0.10
Argentine Div Mining	2	"	1.00
Belcher Divide Mining	3	"	0 01
Belcher Extn Div Mining	5	"	0.10
Ben Hur Divide Mining	6	1,000,000	0.10
Bevis Divide Mining	"	1,500,000	0 10
Brougher Divide Mining	8	1,000,000	
Bullion Divide Mining	4	1,500,000	0 10
Butte Divide Mining	3		0.10
Calumet Divide Mining	1		0.10
Chariot Divide Mining	6		0.10
Combination Divide Mining	3	"	0 10
Congress Divide Mining	3	"	0 10
Crown Divide Mining	6		0 10
Divide Annex Mining	1	1,000,000	
Divide Chariot Mining		1,500,000	0.20
Divide City Mining	6		0 10
Divide Cons'd Mining	8	1,500,000	0 10
Divide Extension Mining	1	1,000,000	
Divide Fraction Mining	4	1,500,000	0 10
Divide Syndicate Mining	3		0 10
East Divide Mining	8	"	0 10
East Div Extension Mining	9	"	0 10
Eureka Divide Mining	7	"	0 10
Frisco Divide Mining	6	"	0 10
Florence Divide Mining	4	—	0 10
Gold Divide Mining	3	"	1.00
Gold Reef Divide Mining	5	"	1 00
Gold Wedge Divide Mining	4	"	
Good Zone Divide Mining	9	"	0.10
Grizzly O. Divide Mining	1	—	0 10
Grimes Divide Mining	5	—	0 10
Hasbrouck Divide Mining	"	—	0 10
Hasbrouck Divide Mining	3	1,000,000	
Hasbrouck Divide Mining	4	1,500,000	0 10
High Divide Extension	6	"	0 10
High Divide Mining	16		1.00
Homestake Divide Mining	6	1,000,000	0 10
Homestake Divide Mining	7	1,500,000	0 20
Hoyt City Divide Mining	"	1,000,000	
Jim Lucky Divide Mining	3	1,500,000	0 10
Kentucky Divide Mining	3	"	0 10
Kentucky Divide Mining	4	—	0 10
Kitty Divide Mining	10	—	0 10
Liberty Divide Mining	3	—	
Lucky Jim Divide Mining	"	1,000,000	0 10
Mammoth Divide Mining	7	1,500,000	
Mayan Divide Mining	5	"	0 10
Mayflower Divide Mining		"	0 10
Mohawk Divide Mining	6		0 10
Maya Divide Mining			0 10
Nevada Divide Mining	6	1,000,000	0 10
North Divide Mining	6	2,000,000	0 10
Northwest Divide Mining	7	1,500,000	0 10
Operator Divide Mining	4		0 10
Pyramid Divide Mines	11		
Reno Divide Mining	5		0 10
Revert Divide Mining	4	"	0 01
Rosetta Divide Mining	1		0 10
Royal Divide Mining	13		0 20
Silver Divide Mines Co	6		0 20
Silver King Divide Mining	2	1,000,000	
Silver Star Divide Mining	5	1,500,000	0 10
Smuggler Divide Mining	3		0 10
Sunbeam Divide Mining	7	"	0 10
Sutherland Divide Mining	6	"	0 10
Toggery Divide Mining	12		0.10
Thomson Divide Mining	7	"	0 20
Tonopah Divide Mining	11	1,250,000	1 00
Tonopah Divide Jr Mining	3	1,500,000	0 10
Tonopah Dividend Mining	6	2,000,000	0 10
Tonopah Hasbrouck Mining	5	1,500,000	
Treadwell Divide Mining			0.10
Trilby Divide Mining	4	"	0 10
Verde Divide Mining	6	"	0 01
Victory Divide Mining	5	2,000,000	0 10
West Divide Mining	5	1,500,000	0 10
West'n Divide Mng & Mlg	5		0 10
Wilson Divide Mining	4	"	0 10
Wonder Divide Mining	2	"	0 10

CRIPPLE CREEK, COLORADO

VINDICATOR FINDS NEW OREBODIES.

Three important discoveries have been made by the Vindicator company during the past two weeks, according to the statement by the general manager, George Stahl. The first at the 1900-ft. level of No. 1 or main shaft of the Vindicator, is in ground south-east of the Lillie mine, formerly owned by the Lillie (C. C.) Gold Mining Co. of England, since defunct. The new vein is 10 ft. between walls, carries ore that will make screenings worth $30 per ton, while the coarse rock will mill close to $10 per ton. The second discovery was made at the 1700-ft. level of the Golden Cycle shaft, corresponding to the 1900-ft. of Vindicator No. 1. The vein is believed to be the same, but the ore was found 500 ft. east of the original discovery. The third orebody has been found on the 1400-ft. level, north of Vindicator No. 1 shaft, where one of the so-called 'townsite' veins, lying under the town of Independence, has been encountered, north-west of the shaft. All three discoveries are in virgin ground, with no work above or below, or near to these points. Vindicator shares have been active during the past week, and advanced 20 cents.

PORCUPINE, ONTARIO

LABOR.—LITIGATION OVER SLIME DUMPS.—ROAD CONSTRUCTION.

The feeling of unrest that has prevailed for some time among miners of northern Ontario fields culminated on June 12 in a strike at Kirkland Lake, where about 500 of the Union miners walked out on the refusal of the mine-owners to yield to their demands. These included a minimum wage of $4.50 per day to underground workers, a 44-hour week, and recognition of the Union. Progress in the strike has been chronicled in the M. & S. P. The strike has also affected the Boston Creek district where work has been largely suspended. There is little danger of its being extended to other centres. Cobalt

miners who had made similar demands, and threatened a walk-out, have agreed to remain at work until the Hon. G. D. Robertson, Federal Minister of Labor, has full opportunity to bring about a settlement. Porcupine miners have asked for a conference with managers, and intimated that they will not demand increased wages provided that the cost of living can be reduced. The proposed method of doing this is establishment of a company store. The influx of unemployed men from Sudbury, Kirkland Lake, and other points into Porcupine and Cobalt makes it highly improbable that any further strikes will be called.

COBALT.—Litigation that has been under way for over two years, between the Peterson Lake Mining Co. and the Dominion Reduction Co., over the ownership of slime from the Dominion Reduction mill on Peterson Lake ground, has resulted in a judgment by the Supreme Court of Canada confirming decisions of the lower courts in favor of the Peterson Lake. The slime is estimated to amount to 220,000 tons, and the silver content from 500,000 to 2,000,000 ounces.

TORONTO, ONTARIO

MINERAL PRODUCTION DURING FIRST QUARTER OF 1919.

Returns received by the Ontario Bureau of Mines for the three months ended March 31, are tabulated below, compared with the corresponding period of 1918:

	Quantity		Value	
	1918	1919	1918	1919
Gold, oz.	113,387	98,188	$2,265,521	$2,026,536
Silver, oz.	4,114,856	3,105,002	3,740,843	3,152,700
Copper, blister, lb.	. .	1,724,631	. .	270,493
*Copper in matte, tons	4,727	2,674	1,748,990	588,280
*Nickel in matte, tons	9,677	5,610	5,806,200	2,692,800
†Iron ore exported, tons	501	4,840	2,638	41,118
‡Iron, pig, tons	17,404	14,170	461,940	399,963
Cobalt, metallic, lb.	37,545	13,594	75,625	20,889
Cobalt oxide, lb.	81,760	127,954	130,486	186,036
Nickel oxide, lb.	.....	5,070		1,421
Nickel, metallic, lb.	44,154	1,830,569	17,662	756,062
Other nickel and cobalt compounds, lb.	143,381	31,370	18,386	11,497
Lead, pig, lb.	60,283	567,716	5,066	34,684
Molybdenite concentrates, lb.	17,410	.....	24,548	.....
Total			$14,297,905	$10,182,479

*Copper in matte was valued at 18½ cents and nickel at 30 cents per pound in 1918. For 1919 the values have been placed at 11 and 24 cents, respectively.

†Including briquettes. Total shipments of iron ore to both foreign and domestic points in 1919 were 32,376 tons valued at $146,741.

‡Total output of pig iron was 170,325 tons worth $4,807,614. Figures in the table represent proportional product from Ontario ore.

The value of the mineral output of the Province for the first quarter of the year reflects the after effects of the War. Nickel and copper show a marked decline both in quantity and value. The position is expected to improve gradually. Silver production has decreased by over a million ounces, but the effect in valuation is not so great owing to the present high price of the metal. Cobalt and nickel oxides, metallic nickel, and lead show an increase in value over the 1918 figures. Fuller explanations are offered under the separate headings.

GOLD. Although the gold output shows a decrease of 24,104 oz., the outlook is such that a substantial increase may be expected for the full year. With the Dome mill now in operation at Porcupine and the Kirkland Lake and Tough-Oakes mills at Kirkland Lake, an improvement is anticipated for the half-yearly report. A great deal of interest is being shown in the goldfields of northern Ontario, and much prospecting and development of new properties is going on. During the period, with the exception of a few days at the end of March, only two mills were operating at Porcupine, namely the Hollinger and McIntyre. At Kirkland Lake the Lake Shore and Teck-Hughes were the only mills at work. For the quarter 206,603 tons of ore were milled as compared with 262,577 tons in 1918. Of the total 94.5% was treated at Porcupine. In addition, 18,620 oz. of silver was recovered from gold ores.

SILVER. Silver from Cobalt and outlying centres was marketed to the extent of 3,080,104 oz. In addition, 24,878 oz. was recovered from the refining of gold ores and nickel-copper matte. Mines producing over 250,000 oz. are given in order: Nipissing, Mining Corporation of Canada, Kerr Lake, and McKinley-Darragh-Savage. Of these, Nipissing marketed over 1,000,000 oz. Some ore assaying over 8000 oz. per ton has been taken from the Foster mine, under lease to Campbell and Fairbairn.

Southern Ontario refineries treated 1257 tons of ore and concentrates, and 919 tons of residues, recovering therefrom 1,354,441 oz. of silver in addition to the cobalt and nickel compounds, as enumerated in the table. Although 170,478 lb. of metallic nickel were produced only 16,284 lb. were marketed.

The market for stellite, used for high-speed cutting tools, has fallen off since the War ended. New uses, however, are being found and a market developed for this product, which is an alloy of the metal cobalt.

NICKEL AND COPPER. There was 229,822 tons of nickel-copper ore raised and 226,954 tons smelted, compared with 354,689 and 325,386 tons, respectively, for the first quarter of 1918. The cessation of hostilities immediately resulted in a decreased nickel demand, and the period of reconstruction has not yet provided a market sufficiently large to absorb the war basis output. In consequence, there has been a great curtailment in production both by the International and Mond companies. The prices also have dropped appreciably, notably in the case of copper. Out of a total output of 12,529 tons of Bessemer matte, 2960 tons was refined at the Port Colborne plant of the International Nickel Co. of Canada, the products being metallic nickel, blister copper, silver, and gold. The last two mentioned are present in small proportion. Heretofore the only metallic nickel recovered in Ontario was the small quantity obtained by the several refineries which treat the silver-cobalt-nickel ores of Cobalt. Since Port Colborne plant commenced in July of last year metallic nickel has been produced within the Province from nickel-copper ores.

MOLYBDENITE AND LEAD. As a result of decreased demand for molybdenum and a marked decline in price, it has not been profitable to operate molybdenite mines since the close of the War.

The entire production of pig lead comes from the mine and smelter operated at Galetta by the James Robertson estate.

ARIZONA

Clifton.—The Stargo Syndicate has made payment to the owners of the Stargo Silver Belt Mining Co. for their 26 claims, which are 1½ miles from Morenci. This property has shipped 1100 carloads of silver ore in the past, when worked by Mexicans. M. J. Hannon reported favorably on the property for the purchasers six months ago.

Courtland.—Twenty-five men are working on the O. T. Smith lease at No. 2 shaft of the Leadville Mining Co. It is reported that a good body of ore has been opened. A few lessees are working on other parts of the Leadville property.

Kingman.—The dry concentrating plant of the McCracken Silver Lead Mines Co. is now operating. Concentrate is said to carry 54% lead and 35 oz. silver. A large orebody has been opened, part of which is shipping ore.

J. A. Hammer is making preparations to start the Fay mine and mill. This property is 8 miles south of Kingman. There is said to be a considerable tonnage of $40 ore available.

Twenty-five men are now being employed at the Rural Mines Co.'s property. A new road is being built, and preparations made to put up a 100-hp. double-drum electric hoist and compressor. A 100-ton mill is to be erected as soon as development opens sufficient ore.

Foundations for machinery necessary to sink the shaft to the 500-ft. level are being put in at the United American mine. Several veins outcrop on the surface and it is proposed to cross-cut these at the 500-ft. level. W. K. Redenour is general manager.

Miami.—Inspiration Consolidated pays $1.50 per share on July 28. This amounts to $1,772,950, and makes $5 per share, $5,909,835, for 1919, and $31,305,915 to date.

Oatman.—The United Eastern Mining Co. has issued its report for 1918, the following being abstracted therefrom:

The operating officials are J. A. Burgess, general manager; W. O. North, assistant; B. D. Boalen, mine foreman; E. M. Bagley, mill foreman; L. E. Ward, master mechanic; B. C. Staiger, mining engineer; R. G. Davies, geologist; Wallace Keith, purchasing agent; and J. W. Bradley, chief clerk.

The gross income was $2,080,923, and charges against same $940,902, leaving an operating profit of $1,140,021. Adding the previous balance of $966,866, there was available $2,106,887. Of this, $713,343 was paid in dividends and $540,617 as capital distributions, leaving $852,927 to be carried forward to 1919. Current assets amount to $872,775, and liabilities $283,580.

Underground exploration totaled 3692 ft. Ore-reserves are larger than they were a year ago, and total 265,663 tons averaging $24.34 per ton. The main shaft is to be deepened from the bottom—1177 ft. On account of the heat and high humidity of the air in the mine forced ventilation is necessary. Underground work cost $4.728 per ton milled, of which $2.818 was for labor.

The mill operated most satisfactorily, treating 253 tons per day (92,339 tons in all), extracting 96.95%. Improvements to classification have increased the capacity to 283 tons. The Crowe vacuum precipitation system effected a decrease of nearly 50% in consumption of zinc-dust. The cost of treatment was $2.216 per ton. Gold extracted amounted to 97,827 oz., and silver 52,485 oz. The ore averaged $23.158 per ton. Operating costs totaled $8.501 per ton, equal to $8.02 per ounce of gold recovered.

Superior.—It is rumored that $100,000, to be spent in development of the Queen Creek Copper Co.'s property, has been voted by shareholders. This sum will not be available until after peace is ratified, when it is expected that the British government will raise the present restrictions on raising capital for foreign enterprises.

Tucson.—After closing his option on the Purcell property at Tucson Buttes, 10 miles from Tucson, T. E. Kelso, has organized the Arizona-Tucson Mining Co., which will take over the claims. A considerable quantity of high-grade copper ore has been accumulated on the dump, awaiting a better market. This property is claimed to have a large area of high-grade ore extending over several claims, the ore being almost on the surface. Development at present is being carried on by hand. This property adjoins the Saginaw, which was drilled a few years ago by the Calumet & Arizona Copper Company.

S. D. Keeny, one of the directors of the Cababi Mining Co. and the Stratton Consolidated Copper Co. is making an inspection of the properties in the Old Hat district. The latter company expects to resume development in August, but will not be working full force till the road from Oracle has been completed.

CALIFORNIA

Alleghany.—An electric hoist recently put in 600 ft. from the mouth of the tunnel at the Mariposa mine, is in operation, and the company intends sinking 500 ft., and prospecting the ground from that point.

Caliente.—The Cove district of Kern county, 42 miles north of this place by wagon-road, is to receive attention from the Big Hill Mining Co., which is to develop the Lady Belle, Bull Run, and Jeff Davis claims. According to G. C. Brown, of the State Accident Commission, in the Los Angeles Chamber of Mines 'Bulletin' for June, in the last report of the State Mining Bureau, on Kern county, the Cove district is described as one of the famous mining regions of the county. The altitude ranges from 2600 to 5000 ft. The natural amphitheatre occupied by this territory is the characteristic which gives it its name. The formation consists of granite and slate, the former predimonating. Nine lodes can be traced on the surface for a considerable distance, as the outcrops are bold. Large treatment plants will make this one of the big producing districts of Kern county, as an abundance of water from the Kern river for power purposes, topography suitable for open-cut mining, and ideal climatic conditions should afford low costs.

There are 12 patented claims in the district that were active gold producers 40 years ago, and have been worked spasmodically since then. The district is credited with a monthly production in the early days of $75,000, with none of the workings more than 400 ft. deep. Production of some of the mines are: Lady Belle, over $1,000,000 in gold; Bull Run, $450,000, deepest workings 360 ft.; and Jeff Davis with $200,000 from 200 ft. depth. The milling average was $40 per ton, with high-grade ore yielding at times as high

as $150 on plates, and concentrate $400 per ton. The large low-grade lodes known to exist in the district, in addition to the possibilities of developing high-grade ore under ideal mining conditions, undoubtedly merit the attention of capital

Colfax.—Pacific Gas & Electric Co. engineers are at the Spaulding dam above Emigrant Gap, in Nevada county, where preparations are being made to add 15 ft. to the 260-ft. structure that holds back the waters of the South Yuba. This is the third addition to its height, and, when completed, will increase the storage capacity over 10,000 acre-feet. There will be no increase in electric energy, the object of the company being to guard against a dry season. Four smaller dams at gorges on the edge of the lake will be raised proportionately.

Forest Hill—A number of men are hauling chromite from this place to rail at Colfax. They say that returns on present low prices are satisfactory.

Nevada City.—Under the superintendency of A. Hoge the California Mining Co. continues to advance the tunnel into Harmony ridge from a point in Willow valley, close to town. This ridge, 20 miles long, has been famous as a gold producer by drift-mining. The company controls a tract of land four miles long and two wide, but the channel, judging from older workings, it is not believed will exceed 200 ft. in width. The tunnel is 6 by 8 ft. in the clear, in hard granite, and has reached a point 650 ft. in the mountain. The underground work is in charge of Charles Kistle and with light machinery is driving the tunnel ahead at the rate of 110 ft. per month. All the machinery is electrically driven.

Grass Valley.—All the mines resumed work on July 1, in accordance with the agreement of June 28. The Empire and North Star mines have greatly reduced forces, and will not be able to operate, except at a disadvantage, for some time. Large quantities of water had accumulated during the 15 days of enforced idleness, and it is now a question of draining the lower levels in order to extract ore. The basis of settlement is substantially the same as heretofore made public, as follows: (1) no bonus; (2) free market; (3) conferences before any proposed strike; (5) one-half pay during time lost on this strike. Section 4 reads: "We propose a percentage increase along the lines suggested by some members of your committee as follows: At the end of a year from date we will pay 10% of the total wages earned by every man who has worked for us continuously throughout the year." This was amended to read: "continuously on the pay-roll," thus protecting men on leave or sick. J. B. Bennett, chairman of the Mine Workers Protective League, will name a committee to close up all details of the strike and to have the agreement, as finally adopted, drawn up and signed by the respective parties. How the free-market idea—goods and supplies at cost—is going to work out is a problem for the future.

The Murchie property, a mile east of town, once famous as a gold producer, was sold on June 27 by the tax collector on account of delinquent taxes. R. E. Steele of San Francisco was purchaser, paying nearly $6500. C. F. Humphrey of Pescadera is an associate owner. No definite plans have as yet been made public.———The West Point claims in the Rough and Ready district have been bought by T. S. Dorsey of Grass Valley.———The H. H. Noble mineral rights within the Nevada City limits were bid in by David Wildin.

Plymouth.—The Plymouth Consolidated in May treated 10,500 tons of ore, yielding $61,100. The net profit was $14,500. The main shaft was cleaned down from 1500 to 2600 ft., preparatory to sinking. On the 1600-ft. level the south foot-wall drift advanced to 770 ft., where the quartz pinched. The shoot was 136 ft. long, averaging $10.25 across 144 inches.

Randsburg.—An extensive silver-gold deposit has been discovered by H. Williams on the flats between the Rand mountains, 1¼ miles east of the Yellow Aster mine and 3 miles north of Atolia. The lode has been traced for 6 miles and is from 60 to 80 ft. wide. Two shipments, assaying 64 oz. silver and $17 gold, have been sent out. John W. Kelley, former sheriff of Bakersfield, and associates, have acquired the Williams property, and started exploration. Numerous claims have been located on the strike of the lode.

COLORADO

Ouray.—The Camp Bird company's quarterly report shows that new work covered 718 ft. The total length of drive east from the tunnel intersection of vein is now 2035 ft. The tunnel-level east extended from the end of the ventilating drift, a distance of 206 ft., is in vein of no commercial value, although containing irregular small shoots ranging in value from a few dollars to $19—silver largely predominating. At a point 1800 ft. from the tunnel intersection a cross-cut was driven south a distance of 200 ft. before the basic andesite-breccia was disclosed, there being for the entire distance alternate quartz streaks and the altered andesite found in the vein and in close proximity throughout the mine. A cross-cut opposite to the north passed into basic andesite in a few feet, confirming the limit of vein in that direction. No value of consequence was disclosed in either of these cross-cuts. Conditions east of these cross-cuts have not been defined, nor will further attempt be made until natural ventilation can be obtained through a connecting raise of about 450 ft. with the ninth level, now in course by the tunnel company. Similar vein conditions pertain on No. 9 level over this point, where the vein splits, the value following the south branch. For that reason an effort was made to disclose this branch on the tunnel-level and raise in it for ventilation, but the disadvantages going with forced ventilation over a stretch of 2½ miles restrain further prospecting until this obstacle is removed. It is considered that vein widths are now identified with cross-cuts between points 1400 and 1800 ft. east of tunnel vein intersection, disclosing various widths, ranging from 6 ft. to 19 ft. The greatest width and best value centre at about 1500 ft. from the intersection, where for a short stretch there is a width of 19 ft., of which 10 ft. returns 0.06 oz. gold and 15 oz. silver. The remainder of the vein does not contain commercial ore. Raises at co-ordinates 1150 and 1185 have been advanced 21 and 26 ft., respectively. In the former, gold is negligible with 10 oz. of silver. The latter, while not exposing the full width of vein, is in a stratum 5 ft. in width, that returns 12 oz. in silver, but no gold of consequence. The ventilating raise is on the vein at co-ordinate 1410, and but recently started. The Tunnel company will now vigorously prosecute the work to a connection with the No. 9 level, and, owing to mechanical ventilating conditions, there will be little opportunity afforded the Camp Bird company to promote further development until after completion of this raise. The flow of water at the mouth of the tunnel is about 1075 g.p.m., making mostly along the line of the tunnel, there being little in tunnel-level east. There is a fair supply of labor, but wages in this district have again been advanced 50 cents per day, making $4.50 the minimum wage scale.

IDAHO

Grangeville.—The Unity Gold Mines Co., in the Warren district, has opened 16 in. of high-grade ore on its 900-ft level. The property is 49 miles from rail. J. H. Hawley is president and J. A. Czizek of Boise is manager.

Mullan.—The Consolidated Interstate-Callahan company is to resume operations at an early date.

MICHIGAN

Houghton.—Seven mines in the Copper Country are producing metal as close to normal as their working force will

permit. They are: Quincy, Mohawk, Wolverine, Victoria, Baltic, Trimountain, and Champion. Eight mines are producing copper at approximately half of normal. They follow: Calumet & Hecla, Isle Royale, Allouez, Centennial, Ahmeek, Osceola, Superior, and Mass. Fifteen active organizations have their properties closed down: Lake Copper, White Pine, La Salle, Franklin, New Baltic, New Arcadian, Hancock Consolidated, Winona, Whie Pine, Cass Copper, Wyandot, South Lake, North Lake, Cherokee, and Indiana. Five exploration properties are continuing development: Seneca, Mayflower, Old Colony, Naumkeag, and Michigan. With reference to the properties that have suspended, it should be understood that mines like the Hancock, Franklin, La Salle, and White Pine are keeping pumps at work, and could be re-opened and become factors, in copper output in a small way, on short notice. The Michigan is included in the list of exploration properties. It is a regular producer, but has a most important future possibility from an exploratory standpoint. More new ground was opened in the lower levels of the mines during June than in any month for two years. The most noteworthy fact in connection therewith is that the general physical condition is better than the average. This applies mostly to the lower levels of the older mines; it is equally applicable to the newer mines, or those working along new lines.

MINNESOTA

Duluth.—At the meeting of safety engineers here on June 20, Albert H. Fay, of the Bureau of Mines, addressed the assemblage on 'The Safety Engineer and Accident Statistics'. The total number of men employed in mines of the Lake Superior district during 1917 was 58,152 and in 1916, 56,787.

MONTANA

The mining industry, particularly in the Rocky Mountain region, with prices of metal increasing, has a bright future, according to A. E. Spriggs, former acting-governor of Montana, who was at Salt Lake City recently, and is now chairman of the State Industrial Accident Board. For some time business in Montana underwent a depression because of the low price of metals, but with copper increasing in value, conditions are improving. It is the opinion of a great many that the price of copper has gone as low as it will for some time. There is a feeling that much of the talk of immense copper stocks to a certain extent was propaganda. This, of course, has done a great deal of good, in that it caused a cut in the production of the red metal which is sure to help the price of copper. There is little doubt that copper will come back and that nothing can stop it. The increased value of silver and its assured future is causing many of the old properties in Montana to resume operations. Records show that at present, of the 74,000 men employed in the State of Montana, 50,000 are at the mines. These figures demonstrate the value of the mining industry to the State and the fact that conditions are improving.

Butte.—The different unions at Butte are to present demands to the companies for increased wages and changes in working conditions. Most contracts expired on July 1.

NEVADA

Austin.—The Austin Dakota company is contemplating erection of a mill at an early date. Large reserves of silver ore are exposed. C. F. Littrell is manager.

The Austin Nevada Consolidated's Hiawatha tunnel has opened shipping ore. The general manager, H. G. Richardson, is to erect a mill soon.

Goldfield.—The Goldfield Development Co. expects to start the Consolidated mill early in August. The Red Top mine is ready to supply 1200 tons of ore daily. When the property is in full operating condition, up to 300 men will be employed.

A cross-cut on the 700-ft. level of the Silver Pick has entered the Silver Pick vein in ground sub-leased from the Goldfield Development Co. and a drift has been driven a short distance south-east. The vein is 6 ft. wide and, while regarded as promising, the material in which the drift is being driven is of no value.

A mild boom is in progress in the Cactus silver district. The Cactus Nevada shaft is down 100 ft. in $46 ore. A winze below this level assays $35 to $190 per ton. Buildings have been erected and machinery put in.——A. L. Minter is sinking a shaft nearby in $100 ore.

Mina.—The Gold Pen mine in the Rand district has been sold to W. W. Wantland of Los Angeles and J. C. Bray of Reno, who have organized the Gold Pen Mines Co., with a capital of $1,500,000 in $1 shares. The mine is five miles north-west of the Simon lead mine. About 2000 ft. of work has been done, including a 258-ft. shaft. Since 1907, over $172,000 in gold has been extracted from high-grade ore-

MAP OF NEVADA

shoots. An electric hoist and compressor, pumps for water-supply, and a 100-ton cyanide mill are to be erected.

Goodsprings.—The Yellow Pine company's new power-plant has been started and hoisting ore is again under way.

Sprucemont.—The Bullshead Mining Co. has purchased a 50-ton smelter and is erecting it at the property in the Spruce Mountain district in Elko county. It is officially stated large bodies of ore averaging 28 oz. silver and 4% lead are blocked out, with an additional 10,000 tons assaying 27 oz. silver and 3% lead.

Tonopah.—The Tonopah Mining Co. during May produced 63,375 oz. of silver and 690 oz. of gold from 4395 tons of ore. The profit was $29,200.

The Pacific States M. & M. Co. has purchased the Cornforth silver mine at Bellehelen, 50 miles from Tonopah. During the past two years intermittent shipments to smelter realized $125,000, the ore being worth $70 per ton. The

cost of mining, transport, and treatment was over $30 per ton.

Winnemucca.—The Reco Divide company, of Divide, has purchased the Paradise Valley mines at Spring City, in the Santa Rosa range, 50 miles north of Winnemucca. This property was first located in 1878, and after being worked for some time, was closed in 1891. Mining was done mainly by tunnels. The total output of silver and gold is placed at $3,000,000, of which $1,000,000 was paid in dividends. Dumps are said to contain 8000 tons of $16 ore. J. B. Kendall is president, and M. A. Kendall is secretary-treasurer.

OREGON

Medford.—The War Eagle Mining Co. was recently incorporated and taken over by local people, who are: C. M. Kid, president; A. L. Hill, secretary and treasurer; Sam Bertelson and Ed Skewis, directors. The property consists of a group of quicksilver claims on upper Evans creek, 25 miles north of Medford. It has been known for many years that cinnabar existed in a considerable area in this region. Some prospecting was done with variable results until Mr. Bertelson and associates opened a vein that, according to the management, has been tapped with a cross-cut tunnel 75 ft. long, driven east and west 275 ft. and raised to the surface 85 ft., and is now sinking to a depth of 280 ft. The vein averages 5½ ft. in width, and carries 3.5 to 4% mercury. There are two batteries of 12 Johnson and McKey retorts. During 1918, August 1 to January 15, they produced 17,425 lb. of metal. At present one battery of retorts is treating three tons of ore daily, saving a little over 100 lb. of mercury. This is not satisfactory, and a change to other methods of extraction is contemplated.

The Dr. Chisholm group adjoins the War Eagle on the south and the Mountain King mine is still farther south by three miles; these have some good exposures of cinnabar.

UTAH

Alta.—The Greater Consolidated Mining Co. proposes to drive a tunnel from below the Maxfield mine in Big Cottonwood canyon, on up through the canyon into the Alta district, cutting under such properties as the Maxfield, Dolly Varden, the Carbonates, Kennebec, Gypsy Blair, Flagstaff, Emma, Alta Con., Prince of Wales, City Rocks, Black Bess, Woodlawn, and other mines, some of which produced ore in the early days.

According to W. Clegg Butt from England, who recently examined this region, the Big Cottonwoods district has a promising future, provided properties are developed along modern lines. Both surface and deep workings indicate that payable deposits exist. The metalliferous rock that is found on the surface in well-defined strata, though badly broken up in places, and the whole geological aspect of the country, justify the mining man in believing that the old workings, as well as the new, could be made to pay dividends if worked with efficient methods. There are a large number of low-grade deposits, which, when graded up with the high-grade galena ore found in this district, would pay well for the working. Of course, there are drawbacks in development of the Cottonwood. One of these is that the strata in places are pretty badly faulted. However, experienced mining men would be able to trace the metalliferous bodies which have been displaced, for by aid of the Zimmerman law, Mr. Butt was enabled to find a lode that had been broken up by a fault.

Tintic.—Ore shipments from this district are totaling around 120 carloads per week. The Tintic Milling Co. last week dispatched 32 tons of bullion, valued at $90,000 to $100,000.

The Tintic Drainage Tunnel is in 3000 ft., with daily progress of 10 ft. At present no timbering is necessary. The tunnel will eventually be six miles long, connecting with the Iron Blossom, Colorado Consolidated, Yankee, May Day, Godiva, and Chief Consolidated.

CANADA

British Columbia

Alice Arm.—The Alice Arm district promises to become an important producer of silver within a few months. The Dolly Varden and Wolf mines, now operated by the Taylor Mining Co., will commence shipping ore at an early date. The Taylor Engineering Co., of Vancouver, has resumed work on the railroad from tidewater to the Dolly Varden mine. At the time of discontinuing work last season the road was completed for a distance of 16 miles from the wharf, to within two miles of the tram. Other properties are being exploited, some showing good veins.

The Alice Arm Commercial Club was recently formed by local people, with H. F. Gordon as secretary, to further development of the district.

The Provincial government has men working on trails. This will place some of the mines that have high-grade ore, but situated farther in the interior, on a shipping basis. The present appropriation for this work is entirely inadequate; however, it is believed that the rapid development shown this season will compel better recognition from the Department and action taken to repair old trails and construct new ones at an early date.

The case of Stewart v. Molybdenum Mining & Reduction Co. has been occupying the attention of the Supreme Court for a week. The plaintiff claims $35,000 under a bond given to himself and partners for two claims at Alice Arm. It was alleged that after a bond had been given to a party named Riel, the claims were allowed to lapse through failure to do the necessary assessment work, that Riel re-located them in his own name, and transferred them to the Molybdenum company, which spent $100,000 in development and plant. The case finally was settled out of Court, Stewart and partners receiving one-third and the company two-thirds interest in the mine and plant.

Nelson.—On June 19 the International Mining Convention gathered here, about 200 strong. The delegates on this day organized a branch of the Canadian Mining Institute for the British Columbia interior. S. S. Fowler was elected chairman, and W. G. Wilson, secretary. On the 20th the delegates were welcomed by the mayor, J. A. McDonald. He was followed by the Hon. John Keen, speaker in the Provincial legislature, who was a pioneer of the Slocan district. L. K. Armstrong, secretary of the A. I. M. & M. E. at Spokane, expressed appreciation for the reception given members. L. O. Howard, of the College of Mines at Pullman, Washington, spoke briefly, saying that he was there to learn something. In the afternoon there was a joint meeting of the A. I. M. & M. E. and the C. M. I., Mr. Fowler occupying the chair. Three interesting papers were read, as follows: 'Mining Methods at the Granby Mines, Phoenix', by C. M. Campbell; 'Nodulizing Copper Concentrate', by Oscar Lachmund; and 'Tunneling Reminiscences', by Major Angus W. Davis.

As chairman of the committee oppointed to investigate the alleged high smelting charges of the Consolidated M. & S. Co. at Trail, Mr. Fowler said that the conclusion reached had been that the company was justified in the increases enforced at that time. It had been justified in the committee's opinion, because it was shown that the smelter had not been making a profit; what profits were made were coming, not from the smelter but from the mines, the property of the company. T. W. Bingay and J. J. Warren, of this company, briefly covered the points at issue. Nicol Thompson and R. R. Bruce commended the committee's work.

On the 21st, Charles Camsell, of the Dominion Geological Survey, gave a talk on the geologic features of British Co-

lumbian gold deposits. The Hon. William Sloan, Minister of Mines, was present, and talked about capital and labor, establishment of an ore-testing plant, iron and steel production, and mining generally in the Province. 'Revival of Local Treatment as Regards Flotation' was the subject of an address by F. A. Thomson, dean of the College of Mines at Moscow, Idaho. He was followed by T. Hodge, professor of geology in the University of Vancouver, who discussed iron and steel in British Columbia. L. K. Armstrong of Spokane joined in the ensuing discussion. William Tomlinson talked about platinum and other minerals found in ultra-basic rocks, including chromite, molybdenite, and tungsten. J. J. Mulholland, a pioneer prospector, gave a 'straight talk' about the unexplored north-west region of the Province. A 'Summary Review of Mining and the Distribution of Min-

MAP OF BRITISH COLUMBIA

erals in the Kootenays' was the subject of an address by A. G. Langley, district engineer for Mineral Survey District No. 5. A paper on the mineralization of northern Manitoba by R. C. Wallace, of The Pas, Manitoba, was read by Mr. Armstrong, who explained that the address had been placed in his hands for submission to the Convention.

Sheep Creek.—At the Queen mine, a tunnel is being driven to open a vein of free-milling gold ore 30 ft. wide on the 700-ft. level. About $100,000 is to be spent in development, in charge of A. W. McCune of Salt Lake City. The mine has been opened by an 800-ft. shaft.

Ontario

Cobalt.—The Buffalo Mines company during the year ended April 30, 1919, produced 625,786 oz. of silver, a decrease of 140,000. Sales totaled 803,738 oz. at $1.01 per ounce. The year's profit was $171,238. Reserves are valued at $288,700 net.

The Nipissing during May extracted silver worth $347,751 from 6829 tons of ore. This is an increase of $127,824 over the April yield. Vein 99 now shows 60 ft. of ore 5 in. wide, assaying over 5000 oz. per ton. Vein 109 has been opened for 230 ft., of which 130 ft. carries over 5000 oz. across a width of 2 inches.

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

J. Parke Channing is at Miami.

Arthur R. Weigall is in London.

G. D. Delprat is at Philadelphia.

J. E. Clennell has gone to London.

L. S. Austin has returned to Salt Lake City.

F. L. Cole sailed from Vancouver for Siberia on the 10th instant.

D. P. Hynes, of the H. L. Hollis company, Chicago, was in San Francisco this week.

John Daniell, of Calumet, Michigan, has been in southern Oregon examining the Almeda Mines Co. and other properties.

Ellsworth Y. Dougherty has been appointed mining geologist in southern Oregon, for the Oregon Bureau of Mines and Geology.

Arthur W. Jenks has returned to New York from Namtu, Burma, where he was smelter manager for the Burma Mines, Limited.

S. Herbert Williams has returned to Ely, as manager for the newly re-organized Boston & Ely Consolidated Mining Co., of New York.

Philip N. Moore is at the Fairmont hotel with the other members of the Minerals Relief Commission, which is now in session in San Francisco.

Ralph Arnold has completed his government service and has resumed his practice as consulting petroleum geologist and engineer with offices in Los Angeles and New York.

George Kislingbury has been examining mines in the old Damascus district, in Placer county, California, and his son, **George D. Kislingbury**, is examining a mine at Dyke, Nevada.

M. W. von Bernewitz has resigned as Assistant Editor of the 'Mining and Scientific Press' and has gone to New York to collaborate with **Walter H. Weed** on the 'Mines Handbook'.

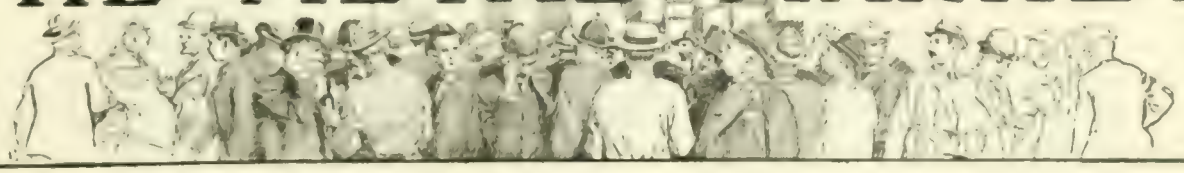
William Robertson, smelter superintendent for the Broken Hill Proprietary Co., is visiting various metallurgical plants in the West. He is now at Salt Lake City and will go later to Butte.

Lewis A. Parsons, after six years of service with the International Nickel Company of Canada as Mine Engineer, has resigned in order to accept appointment as Associate Editor of the 'Mining and Scientific Press'.

Harold A. Linke has completed his war-time service with the U. S. Housing Corporation, Department of Labor, in construction of an industrial town for the Mare Island Navy Yard, at Vallejo, California, and has returned to Salt Lake City, where he has opened offices at 416 Boston Bdg.

The U. S. Bureau of Mines makes the following announcements: **Roy E. Collom** has resigned his position as chief deputy oil and gas supervisor of the State of California, to accept a position with the Bureau as petroleum technologist. His headquarters will be at San Francisco. **F. B. Tough**, formerly petroleum technologist of the Bureau, with headquarters at San Francisco, who is now in charge of the cooperative work being carried on by the Bureau with the Midwest Refining Co. and the Ohio Oil Co., at Casper, Wyoming, spent several days during June in California. He has returned to Denver, where headquarters will be maintained. **Thomas Curtin**, formerly expert driller for the Bureau, with headquarters at the Bartlesville station, has resigned to accept a position as general field manager for the International Petroleum Co., with offices at San Antonio, Texas.

THE METAL MARKET



METAL PRICES

San Francisco July 8

Ammonium chlorid cents per pound	50—60
Antimony cents per pound	8.50
Copper electrolytic cents per pound	20.00
Lead pig cents per pound	5.65—5.65
Platinum pure per ounce	$105
Platinum 10% iridium per ounce	$115
Quicksilver per flask of 75 lb	$100
Spelter cents per pound	8.50
Zinc dust cents per pound	10.00—12.50

EASTERN METAL MARKET

(By wire from New York)

July 8—Copper is stronger and higher. Lead is quiet but firm. Spelter is dull though steady.

SILVER

Below are given official or ticker quotations, in cents per ounce of silver 999 fine. From April 23 1918, the United States government paid $1 per ounce for all silver purchased by it, fixing a maximum of $1.01½ on August 15, 1918, and will continue to pay $1 until the quantity specified under the Act is purchased, probably extending over several years. On May 5, 1919, all restrictions on the metal were removed, resulting in fluctuations. During the restricted period, the British government fixed the maximum price five times, the last being on March 25, 1919, on account of the low rate of sterling exchange, but removed all restrictions on May 10. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the normal rate of exchange.

Date	New York cents	London pence	Average week ending	Cents	Pence
July 2	107.87	53.00	May 27	106.44	52.17
" 3	107.50	53.37	June 3	108.90	52.90
" 4 Holiday			" 10	109.43	53.27
" 5	107.25	53.56	" 17	111.98	54.48
" 6 Sunday			" 24	111.52	54.40
" 7	107.62	53.75	July 1	108.83	53.48
" 8	107.37	53.69	" 8	107.52	53.47

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	75.14	88.72	101.12	July	78.92	99.62	....
Feb.	77.54	85.79	101.12	Aug.	85.40	100.31	....
Mch.	74.13	88.11	101.12	Sept.	100.73	101.12	....
Apr.	72.51	95.35	101.12	Oct.	87.38	101.12	....
May	74.61	99.50	107.23	Nov.	85.97	101.12	....
June	76.44	99.50	110.50	Dec.	85.97	101.12	....

Federal Assay-Offices have been instructed by the Director of the Mint to pay market prices hereafter for silver in gold bullion purchased by them. Before July 1 the Government paid $1 per ounce for such silver. The Government is not in the market for silver at present, but buys all the silver separated in refining gold. The market rate was not paid hitherto, as it was desired to wait until the new fiscal year began.

China continues to be a weak factor, and there has been a decline in the rates both at Shanghai and Hongkong. The political situation and the paucity of exports are contributing to the decline in rates. The Indian position is still unsatisfactory owing to lack of rain and consequent famine.

COPPER

Prices of electrolytic in New York, in cents per pound.

Date		Average week ending	
July 2	18.75	May 27	16.46
" 3	18.25	June 3	16.37
" 4 Holiday		" 10	16.81
" 5 Holiday		" 17	17.58
" 6 Sunday		" 24	17.89
" 7	18.50	July 1	18.37
" 8	18.62	" 8	18.53

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	29.53	23.50	20.43	July	29.67	26.00	....
Feb.	34.57	23.50	17.34	Aug.	27.42	26.00	....
Mch.	36.00	23.50	15.05	Sept.	25.11	26.00	....
Apr.	33.16	23.50	15.23	Oct.	23.50	26.00	....
May	31.69	23.50	15.91	Nov.	23.50	26.00	....
June	32.57	23.50	17.53	Dec.	23.50	26.00	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. Prices, in dollars per flask of 75 pounds:

Date			
June 10	92.00	June 24	95.00
" 17	95.00	July 1	95.00
		" 8	100.00

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	81.00	128.06	103.75	July	102.00	120.00	....
Feb.	126.25	118.00	90.00	Aug.	115.00	120.00	....
Mch.	113.75	112.00	72.80	Sept.	112.00	120.00	....
Apr.	114.50	115.00	73.12	Oct.	102.00	120.00	....
May	104.00	110.00	84.80	Nov.	102.50	120.00	....
June	85.50	112.00	94.40	Dec.	117.42	115.00	....

LEAD

Lead is quoted in cents per pound New York delivery.

Date		Average week ending	
July 2	5.40	May 27	5.25
" 3	5.40	June 3	5.25
" 4 Holiday		" 10	5.20
" 5 Holiday		" 17	5.38
" 6 Sunday		" 24	5.46
" 7	5.40	July 1	5.40
" 8	5.40	" 8	5.40

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	7.64	6.85	5.60	July	10.93	8.03	....
Feb.	9.10	7.07	5.13	Aug.	10.75	8.05	....
Mch.	10.07	7.26	5.24	Sept.	9.07	8.05	....
Apr.	9.38	6.99	5.05	Oct.	6.97	8.05	....
May	10.29	6.88	5.04	Nov.	6.38	8.05	....
June	11.74	7.59	5.32	Dec.	6.49	6.90	....

Lead ore at Joplin last week averaged $60 per ton, basis 80% metal. The Tri-State output was 1264 tons.

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound:

Date		Average week ending	
July 2	7.45	May 27	6.59
" 3	7.45	June 3	6.53
" 4 Holiday		" 10	6.58
" 5 Holiday		" 17	6.88
" 6 Sunday		" 24	7.02
" 7	7.45	July 1	7.36
" 8	7.45	" 8	7.45

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	9.75	7.78	7.44	July	8.98	8.72	....
Feb.	10.45	7.97	6.71	Aug.	8.58	8.87	....
Mch.	10.78	7.67	6.53	Sept.	8.33	9.58	....
Apr.	10.20	7.04	6.49	Oct.	8.32	9.11	....
May	9.41	7.92	6.43	Nov.	7.76	8.75	....
June	9.63	7.92	6.91	Dec.	7.84	8.49	....

Zinc ore at Joplin last week averaged $45 per ton, basis 60% metal. The Tri-State output was 8764 tons.

TIN

Prices in New York, in cents per pound:

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	44.10	85.13	71.50	July	62.60	93.00	....
Feb.	51.47	85.00	72.44	Aug.	62.53	91.33	....
Mch.	54.27	85.00	72.50	Sept.	61.54	80.40	....
Apr.	55.63	88.53	72.50	Oct.	62.24	78.82	....
May	63.21	100.01	72.50	Nov.	74.18	73.67	....
June	61.93	91.00	71.83	Dec.	85.00	71.52	....

Tungsten and other producers are becoming anxious over the delay in the decision of the U. S. Railway Administration as to the policy to be pursued in rating these substances. What threatened to develop into a general re-classification of rates in the West was given publicity through a request from the Denver District Freight Traffic Committee for the promulgation of an order apparently affecting only Colorado shippers. The Committee proposed to cancel released values exceeding $100 per ton, and, in lieu thereof, to increase the rates by 1% per ton of ore, ferro tungsten or blue powder, for every $100 increase in value, being an increase of $1 per ton in freight-rate for every increase in value of $100 per ton or fraction thereof. This ruling would have issued in May but for a lively protest by the American Mining Congress, which held that the precarious condition of the rare-metal industry made further burdens dangerous. A final hearing in Chicago on June 13 was attended by a number of Colorado mining operators, by James F. Callbreath, secretary, and Clifford Thorne, attorney for the Mining Congress. A majority of the members of the Western Freight Traffic Committee and officials of the Railroad Administration heard the arguments made by Mr. Callbreath and Mr. Thorne, the former depicting graphically the destructive results of the order that would close a large number of Colorado mines and de-populate several mining towns. The latter showed that the principle of basing rates upon released value has been voluntarily recognized by the railroads for over a generation, and had been authorized by Act of Congress and approved by the Inter-State Commerce Commission. Both warned against the adoption of such proposed new basic rate throughout the west. During the hearing a number of the Traffic Committeemen expressed themselves as favorable to using the value of the ore at point of origin without adding either transportation or treatment charges, when rates are based on value. They agreed with the shippers that it was wrong to pay freight charged on freight—as is now the practice. That the determination to spread a general order for advanced rates on ores had been agreed upon is now made manifest by a request just filed for increases in rates on base bullion and smelter products from Black Eagle, Anaconda, Basin, Butte, Fuller, Helena, Monarch, Silver, and Wolf Creek, Montana, and Tacoma, Seattle, and Northport, Washington, to Eastern destinations.

Eastern Metal Market

New York, July 2.

The markets are not particularly active because of the turn of the half-year and the approaching holidays incident to July 4. Prices, however, are all strong and some are advancing.

Copper prices continue to increase, but demand and sales are not as heavy as recently.

The tin market is disappointingly quiet, although most of the restrictions have been removed.

Demand for lead is moderate, but prices are strong and some expect an advance.

Zinc prices are firm and tending to advance, but demand and sales have fallen off.

Antimony is unchanged.

IRON AND STEEL

The turn in the steel industry is revealed as definite by the June pig-iron output. The rate per day was 70,495 tons, or 2,114,863 tons for the month, as against 68,002 tons per day or 2,108,056 tons in May, according to 'The Iron Age'. This gain in output was the first check to a steady decline in the daily average from the high point reached in September 1918, at 113,942 tons. There was a gain of five furnaces in the month, 17 blowing in and 12 blowing out. It is estimated by Pittsburgh producers that new orders for rolling in June and June specifications against contracts were 50% heavier than in May, while in wire and tubular products they were nearly double. A labor shortage is threatened in many sections, and this may interfere with fuller operation expected in the fall. June was the best month in the sheet trade since last October.

COPPER

The market continues to develop unusual strength. Prices have advanced almost each day during the last week, although the demand has not been large enough to develop into heavy sales. This is not so much due to lack of interest on the part of consumers as to the disinclination of producers to sell far ahead. It seems not at all improbable now that Judge Gary's prediction that copper would sell at 20c. in the near future, would be verified within a few weeks, perhaps before the end of July, although at that time his optimistic expectations were not shared by the majority of the large copper interests. Already electrolytic copper is quoted and selling today at 19c., New York, July delivery, with some sellers insisting that it can't be bought under 19.25c., while for August delivery 19.25 to 19.50c. is asked and obtained. Lake copper is ¼ to ½c. above these levels. While inquiry has developed for delivery as far ahead as the first quarter there is little selling beyond August, producers generally being sure of a higher market as time goes on and disinclined to commit themselves for the future beyond necessity. Japan continues a buyer, and some other foreign business has developed, but nothing definite has been made known yet as to the needs or intentions of the Germanic countries.

TIN

The market is narrow, restricted, and somewhat disappointing. It is probable that there will be but little trading until normal supplies are the rule as a result of importations and large stocks. Import licenses are being granted for Straits tin for July-August shipment at 50.75c. and for English tin at 50.25c. For Straits tin from England 51.50c. is quoted for shipments as soon as restrictions will permit, this not being metal from point of origin. It is pointed out that in August, besides American tin which is now about 68c., New York, there will also be on the market English tin as well as stocks of Straits metal. The general market the last week has been quiet and the total of transactions has been small. Some consumers low in Straits tin have been endeavoring to purchase metal as stocks in the hands of other consumers or what has been known as the 'allocated' tin and some sales have been made at 70 to 70.50c., New York, for spot delivery. On the whole, buying as a result of the lesser restrictions has been less than expected, but interesting developments are looked for when the market broadens and conditions approach normal.

LEAD

A quiet tone generally prevails, but prices are firm at 5.40c., New York, or 5.15c., St. Louis, the quotation of the American Smelting & Refining Co. There are those who state that as high as 5.45c. has been done, but it is believed by some that this applies to only limited amounts. The fact that the leading interest is understood to be taking no business at all now is said to indicate an advance soon. Demand is not heavy.

ZINC

There has been a lull in the buying of zinc from all sources, but prices show no sign of weakening; on the contrary, they are higher and prime Western for early July delivery today is quoted at 7.10c., St. Louis, or 6.45c., New York, with five points higher for August and September. As in copper, however, sellers are not eager to sell beyond early months and the tone of the market is strong and confident as to the future of prices. Ore prices are also firm and high, which reacts, of course, on zinc. Japan is still a buyer and other export business is good.

ANTIMONY

There is no change and the market is quiet at 8.37½ to 8.62½c., duty paid, for wholesale lots for early delivery.

ALUMINUM

No. 1 virgin metal, 98 to 99% pure, continues unchanged at 33c., New York, duty paid, for wholesale lots for early delivery.

ORES

Manganese: Imports in May were 19,644 gross tons as compared with 29,837 tons in May 1918. The total for the 11 months ended May 31 this year was 440,902 tons as compared with 519,591 tons for the same period in 1918.

Manganese-Iron Alloys: About 6000 tons of American ferro-manganese was sold a week ago in the scramble to take orders at the lower price of $110, delivered. There are now no inquiries before the market and domestic producers are asking $125, delivered. British prices are again lower at $115, seaboard. Spiegeleisen is quoted at $30 to $35, furnace.

Molybdenum: The market is very quiet and prices are nominal at last week's levels of 75 to 85c. per pound of MoS_2 in 90% concentrate.

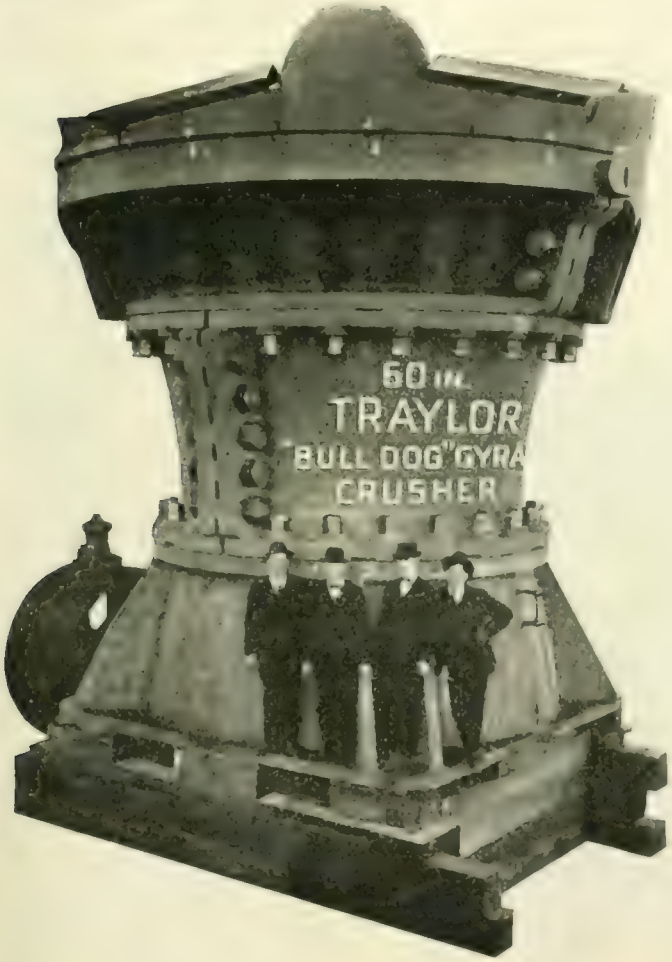
Tungsten: One seller reports considerable activity during the week. Inquiries for high-grade ore are now numerous and frequent. Prices are nominal at $7 to $10 per unit in 60% concentrate. No reported reliable list of the ferro-tungsten market has been brought to light. In Great Britain the low-carbon alloy, 75 to 80% tungsten, is quoted at 3s. per pound, with the metal 96 to 98% at 3s.6d. per pound.

INDUSTRIAL PROGRESS

INFORMATION FURNISHED BY MANUFACTURERS

A GIANT CRUSHER

What is probably the largest gyratory crusher in existence was recently built by the Traylor Engineering & Manufacturing Co. at Allentown, Pennesylvania, for a large company in Michigan.



The giant, which is of the Traylor 'Bulldog' type, has two receiving openings, each 5 by 15 by 10 in., and a capacity of 2500 tons per hour. Some idea of the size of this crusher may be gained from the fact that the shafting alone weighs over 62 tons. The accompanying illustration, showing a man standing beside this shafting, affords a striking comparison. The total weight of the crusher, exclusive of driving pulley, delivery chutes, and foundation, is more than 237 tons.

The development of gyratory-crushers does not show as rapid progress as does that of other mining machinery. The first gyratory was built about 40 years ago. It had receiving openings of 7 by 28 in. and a capacity of 10 tons per hour. Many years passed before capacities had advanced to 50 tons; and another decade elapsed before a 200-ton gyratory was finally built. It is a far cry from that comparatively small capacity to the 2500 tons per hour of the new 60-in. 'Bulldog'.

Credit for the design of this crusher goes to Richard Bernhard and L. J. Hewes, of the Traylor company. Both men have been identified with the development of gyratories since their inception, Mr. Hewes having helped construct the original crusher mentioned, while Mr. Bernhard designed and built the first 200-ton machine.

The Traylor company manufactures a complete line of crushing equipment including rolls and jaw-crushers, for practically any required capacity. Notice the 'baby' gyratory set upon the pulley of the giant 'Bulldog' in the accompanying illustration.

A NEW FASTENER FOR BELTS

A remarkable new fastener, designed for heavy belting and made in sizes for belts varying from $\frac{3}{8}$ in. upward in thickness, is being manufactured by the Flexible Steel Lacing Co. of Chicago. The term given to it is the 'High Duty' fastener.

This appliance embodies a new application of the compression principle as applied to belt fasteners. It consists of two rectangular steel plates, which clamp on either side of the belt and are connected by bolts that go through the belt. The top plate has two round holes, which are counter-

Shaft and Head of Crusher—21 ft. Long, 6¾ ft. Diameter, 65 Tons

sunk to hold the special cone-shaped nuts, while the bottom plate has two special square seats which fit around the square heads of the bolts

The tendency toward increasing thickness in conveyor-belts has demanded a new type of joint, as no satisfactory heavy fastener was available. The high duty joint is simple to apply; it takes only a reasonable time in proportion to the size of the belt. The strength of the joint makes its

modest cost a desirable insurance on the life of the belt. The sizes of the high duty fasteners are proportioned to the thickness of the belt for which they are designed. The illustration shown herewith is from a photograph of the fastener, and shows the construction of the upper and lower plates, as well as the special bolt and nut.

The Flexible Steel Lacing Co. is also the maker of the well-known and popular 'Alligator' belt lacing, Flexco lamp guard, Flexco-Lok lamp-guard, and the Split-Handle portable lamp-guard.

WATER-WHEEL ATTACHED TO CONICAL MILL

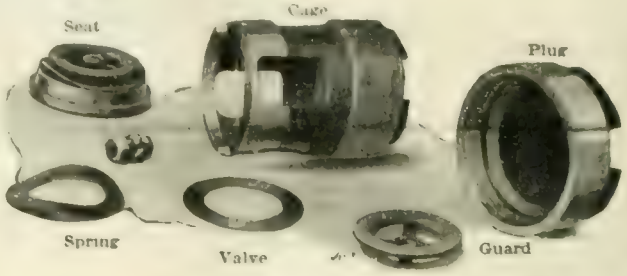
The accompanying pictures show the installation of a Hardinge mill and Dorr classifier at the Empresa Minera Parcoy, Parcoy, Peru, South America. The manager of this plant—Mr. Tarnawiecki—has shown considerable ingenuity in getting around a difficult matter. Apparently there must have been considerable trouble with leather belts, and, as water is much cheaper than leather, he attached some buckets to the pulley on the Hardinge mill, thus converting it into a water-wheel. These buckets were made of steel sleepers taken from a narrow-gauge

railroad track. This plant has been in successful operation for some time.

The Smith-Booth-Usher Co. of Los Angeles has opened offices in the Rialto Bdg., San Francisco. H. A. Olds and J. A. Kinkead will be in charge of the San Francisco house. It is the intention of the company to give a larger and more complete service along the line of contractors', mining, and oilfield equipment.

'WAFER' VALVES FOR COMPRESSORS

Sullivan single stage belt-driven compressors, type WG-6, and the corresponding steam-driven type, WA-6, are now being supplied with the new improved plate valves, developed by the company's engineers at Claremont, New Hampshire works. This valve, known as the Sullivan 'Wafer' valve, is shown in the accompanying illustration. The small



Sullivan 'Wafer' Discharge Valve

size, light weight, and compactness of the valve, also its spring and seat are illustrated.

The 'Wafer' valves seat in cages arranged radially to the axis of the cylinder and close to the two ends of the cylinder, the inlet valve being situated at the bottom and the discharge valve at the top. These valves are held to their seats by flat annular springs of the same material as the valve themselves, which is the finest tempered spring steel obtainable. The valves open against specially designed guard-plates, intended to give a wide port-opening with a minimum of clearance-volume, and without restricting the admission or charge of the air to or from the cylinder. The valve, spring, and guard are easily accessible by the removal of a screw-plug.

The simple and short construction of the springs permits the valves to be placed closer to the bore of the cylinder than is generally permissible with valves of this type, with a corresponding reduction in clearance losses. The light weight of the valves and the superior quality of the material give long life. The question of repair stock is simplified because the same valves, springs, and guards are used for both inlet and discharge.

The valves are employed in multiples of relatively small size, in place of one or two valves of large diameter, the objection to the large valves being the large clearance-pockets required and the likelihood of more noisy action and greater breakage.

Machinery that heretofore has been used almost entirely for the recovery of minerals from their ores is now being applied by the **National Smelting Corporation** of San Francisco to the reclamation of the metallic contents of various industrial refuse. Floor-sweepings, tumbler-barrel mud, emery grindings, broken crucibles, skimmings, oxidized metals, sawings, and other metallic residues, are now being successfully reclaimed at this company's plant. The equipment in present use includes classifiers, jigs, and a Deister-Overstrom sand-table.

We have mentioned that, although the Tariff is [illegible] subject of political the country, our many of our friends have actually read the text of the Payne-Aldrich act [illegible] of the report from of the Committee is this issue hoping that our readers will find it useful in following the forthcoming debate in Congress and in the daily press.

TARIFF. By compliance has now brought within the domain of real life by the successful flight of aeroplane across the Atlantic, at the British aeroplane before the U. S. [illegible]. It is just two years since Blériot first across the English Channel and thereby proved man's conquest of the air. This great achievement of Captain Ferber and the time is for the most significant event since the first of the Wright brothers in 1903.

UNCLE. Democrat" we print a letter from Mr. R. M. Hamilton criticising our effort to [illegible] in using "monopoly and "privilege". We are glad to publish this letter because Mr. Hamilton stands as a careful and thoughtful citizen, worthy [illegible] that any one of those of us should agree in the use [illegible] of technical terms other than we should use them intelligently and thoughtfully. We appreciate the fact that the arguments we have recently given [illegible] to be unsatisfactory. The distinction between the two terms [illegible] the manner in which each is used when describing a monopolizing process. Each, when describing [illegible] harmless, but only on the latter can it [illegible] be maintained justly, as illustrated in the [illegible] to appeal to Mr. Hamilton's letter. The introduction of "privilege" into the argument is undesirable because [illegible] word is already burdened with other significations.

DEFENDANTS. It seems to us, in the case to plant the Kaiser on trial in London. But that he should be [illegible] prosecuted, but the kings of England and of Belgium are his relatives and daughters [illegible] and many of their personal friends. Justice calls for [illegible] to an accounting—he and his dependents with. We would like to see The Times and [illegible] responsible for [illegible] brought to the bar. Shall we make a martyr of William of Hohenzollern or let him live in dreary exile? He is no longer dangerous, the part he [illegible] was overthrown, but he put him and his regime in a box in [illegible] and leave them there forgotten. Whatever is done must be done not in a revengeful spirit but justly and in a [illegible] to other nations and rulers, so that [illegible] rather [illegible] and power, and might may [illegible] over a people with the heart of hearts made into [illegible] lava, whereby we [illegible] down in [illegible] and yet in life and hope [illegible] pain by which men [illegible].

RECLAMATION. [illegible] practice as applied [illegible] one of the chief features in the subject of an interesting institution to our "Discussion" contributed by Mr. Walter G. Dietrich, whose experiences [illegible] California, Nevada, and Arizona, among the most [illegible] in which he has done professional work. But before [illegible] to [illegible] subject on the subject by Mr. H. E. Hyde, who speaks from observation of [illegible]. Mr. Dietrich has expressed [illegible] conclusions, and he [illegible] upon existing operations on a large scale, so that we hope his opposite or [illegible] will be the means of obtaining further valuable information.

THE House of Representatives declared by overwhelming [illegible] the President's veto on the repeal of the Duckpin [illegible] bill and we are glad of it. Not only is the saving of daylight a useful regulation, but the method of attempting to put it in thoroughly [illegible] by making the repeal of the [illegible] of a rider to an important appropriation bill and thereby precipitating a veto on the merits of the measure. This was done by the Senate, in [illegible] and by legislators of [illegible] to pass laws that they do not wish [illegible] or put to the vote. It is a bad [illegible] and thoroughly opposed to the best principles of representative government. We are heartily in support of the President's veto of the appropriation [illegible] bill, which should be separated from the repeal of the Daylight Saving law, a law which has [illegible] to be an [illegible] success. The two legislative measures have nothing to do with each other and should be considered separately on their respective merits. We [illegible] passing these glimpses to the [illegible] background of the [illegible] but the experience of the past [illegible] has amply demonstrated the utility of the system and we hope to see it permanent.

ST. JOHN DEL REY is the richest gold mine, and also the largest metal mine in the world, therefore an annual report is of general interest to the profession. This mine [illegible] in the world, for the [illegible] Del Rey Mining Company was organized in 1898. The [illegible] is located [illegible] the main is in the State of Minas Geraes

in Brazil. Last year the output of gold was worth £423,029, or about $2,000,000 in American money. The average yield from 165,000 tons was $13.27. The profit was $590,244, which was $90,000 less than in 1917, the decrease being due chiefly to the adverse conditions created by the War. A dividend of 10% was paid for the year 1918. The workings have reached a vertical depth of 6326 feet. At the bottom the temperature is 116°F. when the ground is first penetrated, and even the mean temperature of the air underground during the summer is close to 100°, so that particular pains has to be taken to ventilate the mine with a view to rendering working conditions tolerable. The natural increase of temperature is one degree per 126 feet of descent. A large Sirocco fan is used and it is proposed to supplement this with an air-cooling plant. The deeper portion of the mine, below 1940 ft., has been opened up in a most unusual way, by means of a steplike system of winzes and levels, each winze being 1200 feet long and connected with four levels at intervals of 300 feet, so that, as a Cornishman would say, "the h'ore is pulled out by the 'air of the 'ead." The scheme of development depends upon the fact that the workings follow not the dip of the lode but the pitch of the orebody, which stands at an angle of 40°. It is pleasing to note that the size of the orebody and the quality of the ore have shown improvement on the lowest 'horizons', as they are called, although the showing is not so good as it was in the younger days of the mine, the dimensions of the orebody at 5800 feet being about 15 feet by 1000 feet, as against a width of 45 feet and a length of 600 feet in the upper workings. The reserve of ore amounts to 1,209,104 tons. The management is conservative. Mr. George Chalmers has been manager during the life of the mine, and his son, Mr. A. G. W. Chalmers, has recently been appointed assistant manager. We take the opportunity of congratulating the father and of wishing success to the son. Most men outlive most mines; it should cheer the miner to hear about a mine that seems likely to last the time of two generations.

The War Minerals Relief Scandal

From a telegram sent by the Secretary of the American Mining Congress to one of our local newspapers we learn that the Attorney-General at Washington has ruled that, under the War Minerals Relief Act, "no claims based upon general appeal or solicitation will be considered, and claimants must have been asked specifically by one of the five Government agencies named in the Bill." We regret greatly that the Attorney-General should have made such a ruling and that the Secretary of the Interior should have 'passed the buck' by asking him for an interpretation, because the consequence will be nothing short of a breach of good faith. Let us suppose that a miner or mine-operator was approached by one of the young engineers on the staff of our friend Mr. Albert Burch here in San Francisco when he was acting for the U. S. Bureau of Mines in the effort to stimulate the production of the minerals needed by the Government in the waging of war, and let us suppose that in consequence of such personal solicitation this miner or operator, whom we will name A, was induced to engage in the mining of chrome, manganese, tungsten, or pyrite in California. Next, let us imagine the equally likely contingency of B, another miner or mine-operator, seeing one of the circulars of the Bureau of Mines, in a newspaper, urging upon good citizens of our mining districts to engage intensively in the production of the needed minerals, or, to be more specific, let us suppose C, a mining engineer, finding in the 'Mining and Scientific Press' of March 9, 1918, an editorial paragraph stating that Mr. Franklin K. Lane, the Secretary of the Interior, had issued a circular entitled 'How to Save Ships' in which this member of the President's cabinet urged "the energetic exploration and intensive development of certain needed mineral resources," the idea being that if these minerals were produced in the United States it would be possible to release ships then engaged in the foreign mineral trade and use them in the transportation of soldiers and supplies to France during the most critical period of the War. Mr. C, it may be taken for granted, believed what the Editor had written and believed that Mr. Lane was authorized to speak for the Government; to him the message urging the production of chrome or manganese was just as authentic whether it came verbally from a junior member of the staff of the U. S. Bureau of Mines or whether it came in print through a reputable publication; indeed we can imagine Mr. C already starting to work when Mr. A told him about the 'hurry-up call' for war minerals and Mr. C telling Mr. A that he knew all about it already, having read the message of Secretary Lane in the 'Mining and Scientific Press.' Congress has passed a bill to compensate those who went to work to produce the needed minerals in response to the Government's call, that is, to compensate them for loss caused by the collapse of the market as soon as peace became imminent, but the Attorney-General rules that A is entitled to compensation, but B and C are not. Is this just or reasonable? We think not, and we regret what seems to us a great blunder; for the unfairness, if not stupidity, of the distinction established by the Attorney-General smacks of sharp practice. Of course, it is well and honorably meant, but the effect of it will be to besmirch the good name of the Government—not the administration of President Wilson alone, but the Government of the United States, which is more important. What are two or three million dollars compared with the honor of the Government? At any time, but particularly in these days, when we are trying "to make the world safe for democracy," it is of the utmost importance that every form of representative authority—of the City, of the State, of the Federal Government—should set an example not only in honesty, but in honor, in maintaining a code of conduct that shall be emulated by the citizens in their dealings with one another. If those high in authority, if the highest authority of all, the Federal Government, plays fast and loose or side-

steps its obligations. It is a moral calamity no less lamentable than the physical loss of a battleship or the surrender of a battalion in battle. Moreover, this is a poor return for all the publicity cheerfully and gratuitously given by the press of the country to the Government's admonitions and messages during the period of the War. It was wholly impracticable for the officials at the head of the various Federal departments to reach every citizen by letter or circular, therefore it became the practice to send notices to the editors, asking them to draw the attention of their readers to the various calls made by the Government on the people. Newspaper publicity was an essential factor in selling Liberty bonds and in making known the President's endorsement of the campaign for Red Cross funds, and similar propaganda. The press became to the Nation what the town crier was to the village community. Having sent a circular to the editors of the technical press asking them to urge the production of sundry minerals, does the Secretary of the Interior go back upon his responsibility for the ensuing production merely because the appeal was not made personally by him or by one of his employees? We note with pleasure that the American Mining Congress is to take the matter in hand and intends to importune Congress to correct the injustice threatened against the very men whom the War Minerals Relief Act was intended to compensate for performing a service of national importance during the critical period of the War.

The Discovery of Froth-Flotation

On another page we publish a letter from the firm of Sulman & Picard, metallurgists to the Minerals Separation company and sponsors of several of the more important patents on flotation. They enter a not unreasonable protest against sundry remarks of ours on the Wolf patent appearing in our issue of March 22. First we are chided for discussing a matter that is still *sub judice;* and we enter a plea of guilty to this infraction of what we are told is British custom. If we had waited until the controversial features of the flotation process had ceased to be *sub judice* we would have been silent for many years past, and that is a contingency we hate to contemplate, however well it might have suited the friends of Minerals Separation. Even now the subject remains *sub judice,* for the Butte & Superior case is in the hands of the District Court of Montana and the Miami case is still before the Third Circuit Court of Appeals at Philadelphia. However, we shall not upbraid Mr. H. Livingstone Sulman or Mr. Hugh F. K. Picard for discussing matters still *sub judice* in the United States, because in this country the public ventilation of such matters is not deemed improper. Our correspondents send us the transcript of the judgment in the Sulman & Picard *v.* Wolf case as pronounced by Mr. Justice Buckley in 1905, but they say that they hardly expect us to reproduce it in full. Our readers will find these gentlemen to have been too modest in their expectations, for we take pleasure in reproducing the judgment verbatim, realizing the difficulty of giving the gist of it satisfactorily. We might make some further remarks on the Wolf case, but we deem it fairer to let Messrs. Sulman & Picard have the last word as far as we are concerned. Mr. Wolf may feel inclined to reply. We believe that he is still in New York, where we discussed the subject with him in February. It is not necessary to respond to the further strictures from the gentlemen in London. Our reputation for "technical knowledge and business rectitude" calls for no defence at this time. There may be room, it is true, for disagreement as to the rightness of the policy we have adopted in combatting the exactions and inquisitions of the Minerals Separation people. Our attitude has been based upon the conviction that whereas Messrs. Ballot, Sulman, and Picard have contributed largely to the development of the flotation process, they share that honor with many others, for we believe that their supposed discovery of the basic principle was the result of haphazard practice in the Central mill at Broken Hill in 1903 and 1904, not upon the discovery claimed to have been made in the Minerals Separation laboratory in London in 1905. We refer the reader, again, to the paper by Mr. James Hebbard in the Proceedings of the Australasian Institute of Mining Engineers, read by him on November 10, 1913, in which the origin of froth-flotation is, it seems to us, clearly intimated. Mr. Hebbard says: "In the course of ordinary operations, it had long been observed that a froth was formed containing high metallic values, in silver and lead particularly, whenever conditions were favorable, as, for instance, where the rotation of trommels, or the splash of the elevators or raff-wheels, or the motion of the jig-plungers, produced a violent agitation of the mill-water containing slime. Early in 1901 a series of experiments was carried out for the purpose of reproducing and accentuating the conditions responsible for this valuable float-concentrate. Experiments and tests extending over several months, were made on slimes of varying degrees of fineness. . . . It was thus early recognized that the bubbles of froth noticed in the wet-concentration operations were due to the aeration produced by violent agitation, resulting from mechanical implements moving rapidly in water. In these experiments a metallic froth or scum could be produced and recovered assaying 26 oz. silver, 30% lead, and 22% zinc." In December 1904, says Mr. Hebbard, further tests in the Central mill, using only 0.75% of oil, gave results that were "excellent, with all float-concentrate, no granular material being formed." We are informed, at first hand, that as early as 1902 Messrs. W. Shellshear and F. A. Beauchamp suggested the application of the idea, of floating the metallic sulphides over a spitzkasten after agitation, in order to correct the failure of the granulating, or Cattermole, process, and that the suggestion was put to the test in 1903. It was ascertained that the flotative effect was produced while using 9 pounds of oil and 22 pounds of acid per ton of ore. Later the proportion of oil was diminished gradually to 2 pounds per ton. This, we infer, was the real beginning of the froth-flotation proc-

ess as patented by Messrs. Sulman, Picard, and Ballot in the United States on May 29, 1905. It remains to note that the experimental work done in the Central mill was known to the Minerals Separation company. We have made these statements before and they have not been contradicted. On them we base our justification for combatting the efforts of Minerals Separation to secure a monopoly on flotation and to impose their inquisitorial and domineering methods on the metallurgical profession in the United States. We do not deny the inventor's right to a reward from the community, we merely question the assertion that the patentees of 835,120 were the discoverers of the process described in that patent; we believe them to have been developers of the flotation idea, and we concede cheerfully that they have contributed largely to the growth of its metallurgic usefulness, but we believe also that mill-men in this and other countries have contributed to the successful result, some of them in a small way, to be sure, but with an aggregate effect not to be underestimated. For this reason we think it unfair to these and to other inventors to give Minerals Separation the exclusive rights to the process in the United States.

The Miami Case

With reference to the litigation over the flotation patents, more particularly No. 835,120, we think it well to remind our readers that the case of Minerals Separation v. Miami Copper Company is yet *sub judice*. It will be recalled that this case was decided adversely to the Miami company on a strict interpretation of the patent in so far as it controls the type of agitation, because, unfortunately, the Miami company used both a Pachuca agitator and a centrifugal pump in its experimental work and milling operations prior to October 1915, the period covered by the record in the case; but since then the company has used neither of these methods of agitation, depending entirely upon the Callow type of pneumatic machine for the aeration necessary to the formation of an effective froth. At the present time a Master appointed by the lower court, namely, the District Court of Delaware, is hearing evidence on the accounting precedent to an award for such damages as will be levied upon the treatment of the small tonnage of ore covered by the opinion of the Third Circuit Court of Appeals, as promulgated on May 25, 1917. An important feature of the Master's report will be his opinion, after review by the Court, as to whether or not the later milling operations, subsequent to abandonment of the two agitating machines, come under the ban of the Court of Appeals. The point we make is that the pneumatic method of agitation has not come under the ban of infringement. It will be recalled that the decision of the appellate court was divided, two judges upholding the patent, whereas the third dissented. Judge Woolley, in recording the majority opinion, held that "the invention resides not alone in the critical proportion of oil, but also in air and agitation," or, as he expressed himself elsewhere in the decision, "in the co-action of the critical proportion of oil and air effected by 'an agitation greater than and different from that which had been resorted to before', resulting in a froth-concentrate of economical [meaning economic] value." The words quoted by the Judge are taken from the U. S. Supreme Court's decision in the Hyde case, of course. In the recent opinion of the Supreme Court, in the Butte & Superior case, it is held that the "patent is on the process; it is not and cannot be on the result." Judge Buffington, who dissented from the majority opinion of the Third Circuit Court of Appeals in the Miami case, held that the invention was not based only on the use of a minimum proportion of oil and concluded that "the step of the process 'agitating the mixture until the oil-coated mineral matter forms into a froth', meant the novel *air-entraining* agitation which the patentees disclosed, and did not cover the novel *air-releasing* agitation which the defendants disclosed." It is more than likely that the Miami case will be carried to the Supreme Court, in which event there will be presented a record much stronger than either in the Hyde or in the Butte & Superior case. An entirely different phase of the dispute will be submitted. The opinions given in the Butte & Superior case are so different from those delivered in the Miami case as to arouse a feeling of bewilderment in the minds even of engineers familiar with the various litigations. In the one case the crux was the interpretation of the "critical" proportion of oil, that is, as to what fraction of 1% was covered by the patent; in the other case the question was, and still is, as to whether the pneumatic method comes within the scope of the patent. The Ninth Circuit Court of San Francisco in the Butte & Superior case centred its attention on the proportion of oil used in the process; the Third Circuit Court of Philadelphia in the Miami case kept its eye on the character of the agitation employed; each of these appellate courts interpreting the particular part of the Supreme Court's decision in the Hyde case that referred to one phase of the dispute, neglecting other controversial points. In doing so, of course, the lower courts passed judgment only on the points raised in the briefs and arguments of opposing counsel; and the highest court, in turn, adjudicated the issues presented to it from the court below. It is noteworthy how little information is given, in any of the records of these cases, as to the early application of the flotation idea in Australia, particularly the froth-agitation method, which was developed from observation and experiment in the Central mill, at Broken Hill; on the other hand, there is repeated reference to the litigation between Minerals Separation and the Elmore brothers in the English and Australian courts, although the issue in those cases concerned only the old bulk-oil, not the vacuum-air, process of the Elmores, and therefore bore no relation to the froth-agitation process of Minerals Separation. It is evident that it is high time for taking such disputes over patents from the ordinary courts of law and placing them under the jurisdiction of a technical court specially equipped for such investigation and adjudication.

Flotation Litigation

The Editor:

Sir—We have read the editorial in your issue of March 22 entitled 'Flotation Litigation', which we have not commented on earlier as we prefer to follow the usual British practice of refraining from discussing in the press a matter which is still *sub judice*. Now that the case referred to is settled by the Supreme Court of the United States we wish to call the attention of your readers to some facts in regard to our action against Mr. Wolf to which you refer in your article. We can only assume that you did not take the trouble to ascertain the real bearing of this action or that your remarks were based upon an *ex parte* statement.

So that you may be placed in full knowledge of the particulars we enclose herewith transcript of the Judgment of Mr. Justice Buckley in the case. It would be too much to expect you to reproduce the judgment in full, though in justice to ourselves we think you should do so, but if you will be good enough to read it you will no doubt take the opportunity of correcting your statements in an early issue. You will see from the judgment that Messrs. Minerals Separation, Ltd. were not parties to the action directly or indirectly and consequently your statement that "Mr. Wolf, like the Elmores, had an unpleasant experience with Minerals Separation" is incorrect. You will also see that we took action against Mr. Wolf for the recovery of fees for services rendered, and that before accepting an engagement from him we informed him that we had an interest other than that of professional advisors, in a company owning a process which was likely to prove a serious competitor. In the action Mr. Wolf saw fit to counter-claim against us on the grounds that we had (as he alleged) taken out patents in respect of discoveries made whilst in his employ, though he never made any complaint on this or any other pretext till the writ was issued. The judgment makes it clear that this claim was quite untenable on the grounds that there was no similarity either in principle or in detail between the process patented by ourselves and that of Mr. Wolf. In the result judgment was given in our favor for the amount of the claim, whilst the counter-claim was dismissed with costs, the Judge not even calling upon our counsel to reply.

The statement in your article that the judgment held that Sulman & Picard had fulfilled every obligation of their contract is true so far as it goes, but like many statements it only contains a portion of the truth, and is misleading in that the most important points of the judgment are entirely omitted.

We notice that you have in the same issue quoted the Wolf patent in full and that you are recommending or suggesting to users of flotation processes that this might form a foundation for further action against Minerals Separation, whereby they might be successfully robbed of the fruits of their work. We consider it fortunate for the industry that you have quoted this patent in full as no one who has the least technical knowledge of flotation would recognize in Mr. Wolf's patent a process which in any way can be said to anticipate the froth-flotation process as patented by Minerals Separation, and we are surprised that a paper which professes technical knowledge and business rectitude should recommend its readers to adopt such a course.

We know that you lay claim to impartiality, though we regret that in the many attacks which have been made upon us and Minerals Separation in your journal we have not seen evidence of this. With, however, the judgment before you you will have an opportunity not only of displaying this quality but of rectifying the misstatements contained in your article of March 22.

In this matter we have no quarrel with Mr. Wolf, though if your article were inspired by information received from him, his recollection of the events is clearly at fault.

Should Mr. Wolf be advised that the Minerals Separation processes are an infringement of his patent—a view which you evidently hold—we have no doubt that Minerals Separation will be quite prepared to defend themselves against any action which he may wish to take.

SULMAN & PICARD.

London, June 13.

Exit the Blast-Furnace

The Editor:

Sir—Mr. O. E. Jager's article, in your issue of the 21st ult., is a clear broad statement of the trend of current practice in the smelting of copper-sulphide ore and concentrate; as it is backed by the prestige of being the latest expression of Anaconda technology, it is of especial interest to metallurgists.

There is one point that he has not clearly expressed in terms of its real value and importance. In the recapitulation of the merits of the two types of furnaces, the blast-furnace item, "higher cost of power", is not sufficiently defined. Power for tramming the charge, calcine, and slag will be approximately the same in both

cases, therefore the difference represents the cost of compressed air.

The fuel (potential energy) in a blast-furnace is valueless without the compressed air that supplies the oxygen, to promote kinetic energy. This item therefore automatically becomes a money charge with, or on, the fuel when comparing the cost of the fuel consumed in the two types of furnaces. The air for burning the fuel in the reverberatory, being at atmospheric pressure, has no cost against it. This fact is not generally recognized, but nevertheless it indicates the only way of making a true comparison of fuel-cost.

It would be interesting and instructive if Mr. Jager could give detailed figures in terms of heat-units, for instance:

Reverberatory Furnace: Heat-units (fuel) per ton of calcine (at x°C.) smelted.

Blast-Furnace: (1) Heat-units (fuel) per ton of ore or charge smelted. (2) Heat-units (air) per ton of ore or charge smelted, for producing compressed air.

This would put the factor of extraneous applied heat on a basis parallel with kinetic energy, as against cost figures showing fuel in terms of potential energy only.

Mr. Jager has made his comparison between roaster *plus* reverberatory versus blast-furnace, therefore, the heat balances of chemical reactions will, broadly speaking, cancel one another and the question of reducing only the fuel in the different types of furnaces to segregated relative and comparative terms becomes important.

The reason that I emphasize this particular point is that I go further than Mr. Jager and believe that even in pyritic smelting, using only 1½ to 2% coke to the charge, the apparent saving by smelting this type of ore in blast-furnaces is anything but real, if the cost of air for the production of kinetic energy is stated in terms of the extraneous fuel used. For purposes of comparison, the reverberatory furnace must be given an equivalent direct heat-unit credit for smelting calcine. The heat-balances from the chemical reactions of the material being treated will be the same in both cases, even though the mechanical means of obtaining them are very different. The problem, then, comes down to whether it is better, technically and financially, to use a certain amount of money in terms of heat-units, for compressing air for blast-furnace smelting, or to use the equivalent sum, more or less, for direct heat-units applied as fuel for smelting hot calcine in a reverberatory furnace.

If the run-of-mine ore from a pyritic deposit be taken as an instance, 15% must be screened out as fine, another 10 to 15% will be blown out of the furnace and recovered as flue-dust, therefore 25 to 30% of the total ore must under any circumstances be treated in roasting and reverberatory furnaces, or go through some process that will render it physically suitable to become part of the blast-furnace charge. The smelting of these products is a cost on the blast-furnace, which is thus seen to be a defective machine for smelting, when compared with roaster and reverberatory, which will smelt not only the material the blast-furnace cannot handle, but also that which it can, namely, the coarse ore. It is not sufficiently recognized that even coarse ore decrepitates, and becomes fine, just as soon as it comes in contact with heat, when the sulphide portion is in sufficient proportion to cause it to be classified as pyritic ore (about 90% iron sulphide, FeS_2). The statement regarding decrepitation does not apply in the same exaggerated degree to pyrrhotite or to those ores in which the percentage of complex silicate gangue ranges from 20 to 30% or more. This type of ore, however, has passed out of the domain of pyritic smelting, becoming semi-pyritic, and the problem of smelting it becomes even worse for the blast-furnace, because the fines and flue-dust problems still remain in varying degrees. One of two courses for smelting such material in a blast-furnace has to be followed; either the entire tonnage must be roasted in heaps, with its attendant costs of handling and re-handling, its roast-yard waste, and leaching losses, or it must be smelted, or melted, in a blast-furnace at a high cost for coke, plus air, to separate the gangue from the mineral, throwing the load of 'raising' the low-grade matte to a marketable form on the converters. Following this procedure there is a second extra charge for compressed air necessary by virtue of the large volume of low-grade matte produced; only this time instead of the 40 oz. of air already used in the blast-furnace, mostly for burning the fuel, 10 to 12 lb. air has got to be compressed for bessemerizing.

There are local conditions that change the financial aspect of smelting a given ore in any particular locality, but even then there are few cases where blast-furnace smelting can justify its existence, when compared with modern roasting and reverberatory practice for any sulphide material that comes under the classification of direct smelting. The question then resolves itself to whether the reverberatory is a fully developed machine as at present used. I do not think it is, and it will not even start on the way to perfection until the waste-heat boiler is scrapped along with the blast-furnace, and the logical method is adopted of using the waste heat in properly designed regenerators, which will return the heat-units directly to the furnace itself in live air.

In the non-reversible regenerative furnace built at Kyshtim, Russia, and described in an article in the 'Mining and Scientific Press' of June 2, 1917, the following furnace temperatures are shown:

At bridge-wall 2732°F.

At throat 2372°, a drop of 360° in 90 to 100 ft. of length.

At stack 450°.

Hot live air to furnace from regenerator at 900°.

This furnace is 16 ft. wide by 90 or 100 ft. long, the fuel used is gas of low calorific value, produced from a lignitic coal yielding about 8000 B.T.U., and containing about 30% ash. It is easy to see that if the fuel were pulverized coal of 12,000 B.T.U. value or crude oil, an initial temperature of 2900° at the bridge and 2550°, or better, at the throat would easily be attainable.

The old double-ended regenerative furnaces formerly

used at Great Falls.* Montana, showed a temperature of 2650° at the bridge and 2550° at the throat, or a drop of only 100° F. in a length of 41 ft. 6 in. At this low initial temperature, the furnace smelted 31.5 tons per 100 sq. ft. of hearth-area, the average temperature of the calcine charged being 788°. This furnace evidently worked under the same disadvantage as that at Kyshtim by having gas of low thermal value.

The above figures show that with regenerated or heated live air furnished at the point of combustion of the fuel a very even temperature can be maintained the entire length of the furnace, which, of course, is the ideal condition for obtaining the highest furnace capacity per unit of hearth-area in reverberatory smelting. This cannot be done in current practice, even under the best of conditions so far produced.

The latest data on this point are given† in the account of the work of Capt. Stout at the Copper Queen plant, which shows that reverberatory smelting is all a matter of applying or conserving heat-units. By enlarging the throat of the furnace and decreasing the velocity of the gases in the furnace he obtained higher continuous temperatures more evenly throughout the length of the furnace, but the limit was reached in two ways; the obstruction caused by the boilers prevented further development in this direction, and the temperature of the emitted waste gases became so high that the boiler-tubes burned out, showing that the limit of the use of waste-heat boilers from a mechanical standpoint was at least indicated. The data in the article upon the fuel-ratio and smelting-capacity of the furnace are of great importance on the effect of the proper conservation of the heat-units. It is pointed out that with calcine at 200° 0.95 bbl. of oil is required per ton of calcine smelted, but it is estimated that only 0.45 bbl. will be necessary with calcine charged at a temperature of 1150°F. This is of especial importance when considering the problem of smelting pyritic ore in a reverberatory furnace, and it is easy to see that with the high excess heat produced by the chemical reactions in treating this type of ore, a thoroughly mixed charge, at 1100° to 1300° can be considered practicable, if heat conservation in the roasting section be taken care of in the plant design by the insulation of hoppers and cars.

The above-mentioned Copper Queen data are all in reference to reverberatory furnaces, using waste-heat boilers, to save the heat-units from the waste gas leaving the furnace; they have no reference to the further development of reverberatory furnaces along the line of waste-heat saving by means of properly designed regenerators.

In the old days of grate-firing a ratio of 4 tons of calcine to 1 ton of coal, and the smelting of 10 to 12 tons of calcine per 100 sq. ft. of hearth-area was considered good average work for a reverberatory. With the introduction of pulverized fuel the tonnage smelted per 100 sq. ft. of hearth-area increased to 21 or 22 with a fuel ratio of 6 tons of calcine per ton of coal. The increase in capacity is nearly 100% and the decrease in fuel consumption is 50%. This increased efficiency is due almost entirely to the more efficient method of burning the fuel. Three factors are principally responsible: (1) carbon or coke losses in ash are avoided; (2) complete combustion takes place instantaneously; (3) there is no moisture in the fuel; the actual efficiency of the furnace itself in using the developed heat-units is nearly the same relatively when burning pulverized coal as it was when the coal was fired on grates.

The average heat-balances of reverberatory furnaces using waste-heat boilers and emitting stack-gases at about 900°, and the thermal distribution is approximately as follows:

Heat absorbed in smelting, radiation, and other furnace losses 25% of B.T.U. in the fuel.

Waste-heat boiler credits 35% of B.T.U.

Lost up the stack at 900°.40% of B.T.U.

The value 35% of the B.T.U. shown as waste-heat credit is of decidedly doubtful accuracy by virtue of the fact that no furnace synchronizes absolutely with the boilers; consequently at times the boilers are under-fired, and sometimes they are over-fired, thus causing them to 'blow-off', with a consequent loss of a portion of the B.T.U. that have been converted into steam and probably entered erroneously as a credit.

This condition necessitates that the central power-plant shall always have a boiler, or several boilers, under steam to act as a governor to regulate the steam required for maintaining the constant load. In small plants, of one or two furnaces, this condition is more exaggerated than in larger plants. I think that even with the recent improvements in reverberatory smelting this is still an important adverse factor and should modify the value of the steam from waste-heat boilers being considered as all real money, in terms of fuel in bins.

Now, bearing in mind the above figures and the line of argument, let us carefully examine what will be the position if we change our present practice to one in which we use a non-reversing regenerative reverberatory furnace for copper smelting, in order that we may recover the waste heat in such form that the saving becomes real and absolute. This positiveness of results is assured in regenerative furnaces only, since the furnace, dust-chamber, and regenerators are in a closed circuit and final heat-losses can only occur by radiation, or up the stack. It does not matter what the temperature of the gases is when leaving the throat of the furnace, as their heat is returned to the point of ignition, in order to reduce the quantity of initial fuel needed to maintain any desired temperature in the furnace. The additional advantage is shown in the working of the Kyshtim and Great Falls furnaces of maintaining an even temperature throughout the entire length of the hearth. This can never be accomplished so successfully and the same high temperature maintained throughout the furnace when using waste-heat boilers for two reasons: the boiler-

*E. P. Mathewson, 'The Development of the Reverberatory Furnace', Trans. A. I. M. E., Cleveland meeting, 1912.

†'Eng. & Min. Jour.', July 20, 1918. 'Notes on Recent Metallurgical Progress', by E. P. Mathewson.

tubes would burn out, and the eventual waste of heat-units in waste gases would be too high to be considered the full achievement of the greatest possible economy.

A heat-balance of the regenerative reverberatory furnace has been estimated, after a careful survey, as follows:

	B.T.U. in fuel %
Heat absorbed in furnace in smelting and radiation	35
Regenerator loss	10
Stack loss at 1100°F	15
B.T.U. returned to furnace through regenerator in live air	50

So that in the regenerator there will be 35% plus 15%, equalling 50% of the thermal value of the original fuel absorbed and transferred from the waste gases to live air, having no uncertain value, as the equivalent fuel is still 'on hand' in bins, or if it is used in the furnace it will smelt 100% more in quantity of charge.

It is obvious from these figures that even though the use of pulverized coal has decreased the amount of fuel required for smelting a ton of calcine by 50% and has increased the tonnage of calcine smelted per ton of fuel by 100% over grate-firing, this saving can again be repeated by the adoption of regeneration, as set out in the previous and in the following tables:

Calcine Smelted Per 100 sq. ft. of Hearth-Area

	Fuel ratio
Grate-firing, 10 to 12 tons	4 : 1
Pulverized coal or oil, 20 to 22 tons	6 : 1
Water-gas regenerators, 40 to 44 tons	12 : 1

That these figures are in no wise chimerical has been demonstrated by the Great Falls regenerative furnaces smelting 31.5 tons per 100 sq. ft. of hearth-area with only 100° drop in temperature in 41.6 ft. of hearth-length and 360° temperature drop at Kyshtim in 90 to 100 ft. of hearth-length, in both cases having low initial temperatures on account of using fuel of low calorific value.

There is no reasonable doubt that the most efficient American reverberatory smelting practice so far recorded, was that of the old Great Falls regenerative furnaces with every possible factor that leads to success against them; a few of which were: (1) low B.T.U. value of the fuel used; (2) high ash and carbon loss in producers; (3) small old type of inefficient producers; (4) long gas-conduits; (5) regenerators of improper designs, but the standard of the period; (6) regenerators not of sufficient capacity to absorb waste-gas heat-units; (7) furnace too small in relation to the modern furnaces; (8) loss of efficiency due to checkers clogging with dust accretions.

It was with a knowledge of these facts and having to meet the condition of low-grade fuel, at a time when pulverized coal had not yet become a factor in smelting, that I sought a solution of the problem of the successful application of the regenerative principle to reverberatory furnace construction and practice, which eventually ended in the design given in the article in the 'Mining and Scientific Press' of June 2, 1917. This is essentially a dust-chamber, placed between the furnace and the regenerator, through which the gases pass at a reduced velocity, to settle the dust and semi-molten particles that escape through the throat of the furnace; and a double-chamber regenerator through which the gas passes with an up-cast, in contrast to the old Siemens principle of no dust-settling appliance and a down-cast flow for the outgoing gases, in which the dust and semi-molten particles formed accretions on the top tiers of the checker-work and blocked up the whole area of the apertures. Such mechanical difficulties are overcome by the use of a chamber which takes out most of the dust that it is possible to settle, and that which does go over can do no harm, as with the up-cast feature any dust that settled out of the gases must fall back clear of the checker-work, where it can do no damage.

There is nothing new or mysterious about regenerative furnaces, as furnaces and their value has been demonstrated in steel practice. The open-hearth process of steel-making would probably never have been developed had it not been for the Siemens regenerative furnace, as the uniform temperature required cannot be maintained in the length of furnace necessary by direct firing, without incurring heat losses that would become an economic impossibility, as it is not the high temperature that is required at one point, but an even one throughout the length of the furnace that is the chief factor. The furnace temperature required is 2800 to 2900°F. The reversing or end-over-end principle is essential in open-hearth steel-making, otherwise the steel at the end farthest from the reducing action of the combustion of the fuel would be slightly oxidized; and this the reversing principle corrects.

In copper smelting, the single and non-reversing feature is nearly essential, because of the necessity of having one end of the furnace 'quiet' for slag-settling purposes. This fact was the second problem that was faced in solving the application of regenerative furnaces to copper smelting.

In all probability a smelting charge consisting of roasted pyrite and quartz flux of 94% SiO_2 such as would be used for pyritic smelting in blast-furnaces and at approximately 1150° would smelt with less applied fuel than a Copper Queen furnace-charge and give a higher metal recovery than either blast-furnace, or, a combination of blast and reverberatory furnaces, possibly could; so that power for air plus extraneous fuel has got to bear comparison with probably 120 lb. of 12,000 B.T.U. coal per ton of calcine in a regenerative reverberatory and make an equally good recovery to keep the blast-furnace in competition even for pyritic smelting.

The mechanical difficulty of smelting the type of charge producing a basic slag disappeared with the introduction of side charging of reverberatory furnaces, as it eliminates side-wall corrosion and the necessity for fettling. Another factor is that a high stack becomes unnecessary; in fact, it is to be avoided. The regenerator itself when properly constructed is a stack in a horizontal position; therefore all that is required further is a steel stack such as would be used for a boiler-plant. That this is no conjecture will be observed by a visit to any open-hearth steel-plant where each furnace has its own steel stack about 100 ft. high. The lower the

velocity of the gases in the furnace and regenerator, the greater will be the efficiency of the furnace.

It has been demonstrated that the blast-furnace is an obsolete machine for economical smelting. The reverberatory furnace with boilers for saving the waste heat from the outgoing gases has reached, or at least shown, its limitations of development, both mechanical and economical. At the same time the necessity for further progress in the economics of smelting has never been so great as today. The regenerative furnace is a logical development and strikes at the root of real economy.

A radical change today becomes obvious common sense tomorrow, but it takes time to break away from old ideas and get used to thinking in terms of new ones, as was the case with the adoption of the basic-lined converter, and of oil flotation, which, especially as to the latter, had considerable justification, because it involved accepting new principles, but with regenerators this should not be so, because their effectiveness for the recovery of waste-heat units has been known for years, even though the plan on which they were developed was not suitable for copper smelting. If, however, it had been possible to take a regenerator checker-work and canals filled with flue-dust and invert or turn it upside down, the obvious would have happened and the furnace would have continued working. This is precisely the principle of the design of the non-reversing regenerative furnace, with this addition, that a dust-settling chamber is provided to free the gases of the major portion of their dust, before proceeding to the inverted or upside-down regenerator, which again has further protection in so far that the checker-work is sectionalized into small parts and easily accessible, enabling any section to be removed and replaced while the furnace is in operation, or at the worst, shutting off the fuel for an hour or two. It will be apparent from this explanation that the regenerators as a whole are practically indestructible.

Having pointed out the structural features, I think it safe to repeat that from an operating standpoint it is not possible to create the favorable uniform temperature required for perfect smelting conditions except in a regenerative furnace, and that by the use of a properly balanced furnace unit an increase in capacity of 100% can be expected or a decrease in fuel consumption of 50% per ton of calcine smelted can be safely estimated. Referring back to the Copper Queen data, it is there estimated that 0.45 bbl. of oil per ton of calcine is required if the temperature of the calcine charged is 1150° F. If a regenerative furnace were used, this amount of oil may be divided by 2; thus 0.225 bbl. of oil per ton of calcine smelted or 122.5 lb. of coal at 12,000 B.T.U. per pound.

It is a pertinent fact that an attempt to operate a non-regenerative reverberatory furnace with waste-heat boilers attached and having a hearth-length of 100 ft. or 110 ft., and using fuel of such low calorific value, only creating an initial temperature at the bridge-wall of the furnace of 2650° to 2750° and a probable throat temperature of 1500° to 1600° would be a failure, because the slag bath would be 'frozen' some distance back from the skimming-door, and the steam produced in the waste-heat boilers would be of little or no value.

It is also a fact that the old Great Falls regenerative furnaces, having a hearth-length of 41 ft. 6 in., but with inefficient regenerators and the Kyshtim furnace with a hearth-length of 90 or 100 ft., but with efficient regenerators, did use fuel of such low calorific value that it did create initial bridge-wall temperatures of only 2650° and 2750°, but, owing to the element of the conversion and regeneration of the waste-units to hot live air, the throat temperatures were only 100° less in 41 ft. 6 in. of hearth-length and 360° less in 100 ft. of hearth-length, respectively. These regenerative furnaces did work more successfully than any non-regenerative furnace ever recorded, even when this latter type is provided with fuel of the most concentrated and highest calorific value obtainable (fuel-oil). This is sufficient evidence to satisfy even the most skeptical of the effectiveness of the principle of converting the waste heat into regenerated live air returnable to the furnace; it is a logical step in the development of a machine for economical and efficient copper smelting.

WALTER G. PERKINS.

Palo Alto, California, July 7.

Employment Management

The Editor:

Sir—Referring to Mr. Nye's article on this subject in your issue of June 14, I beg to say that, irrespective of the abnormal labor conditions mentioned, Mr. Nye and the Eagle Mining Co. are pointing out the right course for the settlement of the labor problem. The workingman is looking primarily for an 'honest deal'. Give it to him and convince him so clearly that he is getting it that no ranting agitator can shake his faith. You have a suspicious oft-cheated subject to convert, but it can be done; and with surprising ease, for it is the goal toward which he himself with his unions and lock-outs is striving.

Our method must include both cold-blooded statistics and an intelligent personal interest. Where statistics alone are relied upon a large labor turn-over is likely to occur. Where the personal factor predominates we often find inefficiency. A happy medium is the ideal. It is rather hard for a boss to attain this ideal without assistance from higher up.

One successful method of reducing the labor turn-over is in keeping the boss, second above the men, as aloof as possible and using him as a court of appeal. For instance, if the foreman can refrain from giving direct orders to the men, the shift-boss can use him as this court. There is a psychological effect from the realization by the worker that, besides pleasing the shift-boss, he must also please the foreman, whose criticism he never hears but who drops a word of praise for good work. Merited praise stimulates all of us.

Under Mr. Nye's system the employment manager assumes many of the duties of the court. This curb to hasty decisions is equally effective on the workman and on the boss.

The workingman goes to sleep each night with a lot of unused brain energy. This energy is continually seeking an outlet. If not intelligently directed, it often leads to some form of mischief. The majority of a man's inconsequential wrongs become real and all-absorbing during the hours he is whittling a stick. Consequently, given the usual normal crew of men, start them at poker or solo, provided you can think of nothing more original. But get them interested in something which will take care of that brain energy. And do not forget that you get the best out of a man when he is doing something of benefit to his fellow-man. Make a limited amount of his pleasure include something of this nature.

Butte, June 22. J. C. METGER.

[This is a good letter; it contains many excellent suggestions.—EDITOR.]

'Extraction' or 'Recovery'?

The Editor:

Sir—In a recent communication of mine to your journal I made use of the word 'extraction' to signify the quantity of a given metal removed from an ore-pulp as shown by assay of the residue or tailing. If I remember rightly you, Sir, though you were good enough not to edit my term, have in time past taken exception to this use of the word 'extraction', holding that 'recovery' is correct at this stage of the process and that extraction does not take place until the metal in question has been reduced to a condition suitable for marketing. As I have never been able to see eye to eye with you in this distinction I hope you will allow me to set forth the opposite view with my reasons for favoring it.

There are two aspects of this question: the first is as it concerns concentration processes, in which the metallurgic content of the original ore is for the most part collected into a comparatively small bulk of material and thus separated from the gangue or worthless part, though in the majority of cases not in the metallic form, and the second as applied to leaching processes, in which water or a chemical solution is made to dissolve the desired metal or its salt and thus remove it from the gangue, leaving a comparatively worthless residue behind. Now considering the second case first, I can see no word that fits the circumstances better than 'extraction': under the word 'extract' Webster's dictionary gives, "To draw out, select, quote, distill." The word 'recover' has no suggestion of any idea common to the word 'extract', and is explained by the same authority as meaning "to get possession of again." Now the metal that is separated from the gangue by leaching (or, that is, as I claim, "extracted") we do not always "get possession of" ("recover"), as some of us who have operated cyanide plants know to our cost; therefore it seems to savor somewhat of counting one's chickens before they are hatched to say that we have recovered so many ounces of silver when that quantity has merely been extracted from the ore and has not as yet been safely stored in our strong-room.

Turning now to the aspect of the controversy that is concerned with the separation of a mineral containing the desired metal from the worthless part of the ore, the case is not quite so clear. Here, as you have already pointed out, when one has separated metal combined as a sulphide from the gangue one has not obtained metal but merely a mineral of the metal; it might therefore be asserted that literally one has not 'extracted' the metal; but, on the other hand, it seems equally plain that one has not 'recovered' the metal, but merely a product having a higher metal-content than the original ore. Thus the objection raised against the one word would apply with equal force to the other. What shall we do then? Shall we try to bring into use a new word that may more literally interpret the facts of the case, as for instance 'abstract'? This word seems to express fairly well the idea of "drawing away" the copper in whatever combination it may be found, from the worthless part of the ore, leaving it to a further process to extract or "draw it out" from its combination, though the use of the corresponding noun 'abstraction' would seem hardly so suitable. Or on the other hand, shall we waive literal accuracy for the sake of uniformity of nomenclature and adopt in the case of concentration the terms that are by the most common usage applied to leaching processes? After all, even in the case of concentration, if one looks at the question from the point of view of the tailing rather than of the concentrate, the copper that was originally associated with that tailing is there no longer; it has been 'drawn out' or 'selected'; its form after the operation does not matter to the tailing which only knows that its erstwhile companion has been by some means or other "drawn out of" or "extracted" from it.

To illustrate my understanding of the essential signification and differentiation of the two words in question, I will suppose that a certain man is breaking up a packing-case to make a kitchen-shelf for his better half. As a preliminary to further action, he will probably find it necessary to 'extract' the nails. He may then do one of two things: he may either throw away, or, if he is of thrifty disposition, he may straighten them out and put them into his tool box. If he does the latter he will have 'recovered' the nails in addition to having 'extracted' them.

E. M. HAMILTON.

San Francisco, July 5.

[The copper, for example, in a 2% ore is 'recovered' in a 35% concentrate, but it is 'extracted' in a 98% blister because this last is marketable as metal. The gold in a mill is 'recovered' in the cyanide solution, but it is not 'extracted' until precipitated in the zinc-box. Like the amalgam in a stamp-mill, the precipitate in a cyanide-plant is a product so concentrated and so valuable as to be marketable. Answering Mr. Hamilton's suggestion, we would say that the gold in solution is in our possession as compared with its former state in the crude ore, and that successful precipitation usually so nearly ensures extraction as to be considered an accomplished fact.—EDITOR.]

Prolonging the Life of the Roofs of Reverberatory Furnaces at Anaconda

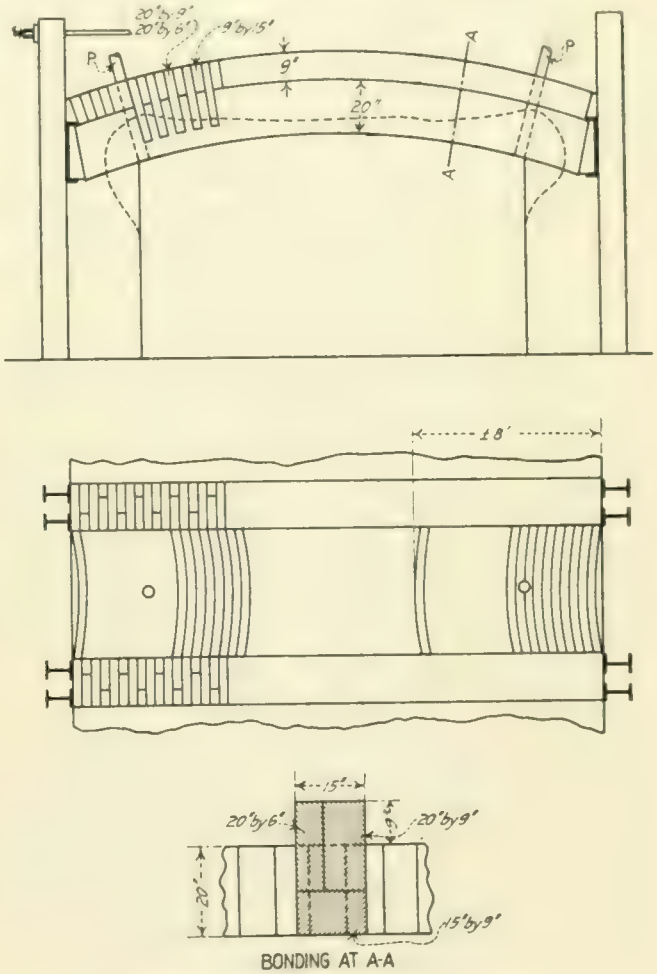
By OLIVER E. JAGER

The present practice of building ribs on the roofs of the reverberatory furnaces at Anaconda is an interesting example of the revival of an old idea. At the Colorado smelter in Butte, the reverberatory roofs were built this way in 1899, and the scheme was tried on the first 50-ft. furnaces built at the present Anaconda reduction works in 1902. The lack of a sufficient variety of brick-shapes at that time caused the practice to be discontinued as impracticable. This difficulty has disappeared under present conditions, as plenty of different shapes are now

RIBS ON ROOF OF REVERBERATORY FURNACE

available. This is an important point, since the success of the scheme depends on good bonding, so that there will be no opening, nor falling, of the roof between the ribs when the furnace is allowed to cool for repairs. The idea is that, when the roof has burned thin, the space between the ribs is filled with brickwork, thus forming a new roof on top of the old one. As the ribs project nine inches above the surface of the roof, the additional thickness of roof will be limited to this amount, but the furnace campaign will be prolonged about two months. The ribs also help to keep the wide roof from buckling or otherwise getting out of shape. The system has been in use at Anaconda for three years.

In filling between the ribs, the brickwork is bonded longitudinally, but no attempt is made to tie it into the ribs; nor is it necessary to build this nine-inch structure completely across the furnace, as the crown of the arch does not burn out as much as the parts near the walls. While the amount will vary according to the condition of the roof, it has usually been found sufficient, on a furnace 22 ft. wide, to extend the nine-inch structure seven or eight feet from the buckstays toward the crown. This is shown in the sketch (Fig. 1), which also illustrates how the reverberatory furnaces burn out, the dotted line in the sectional view giving approximately the outline produced. The fluxing action of the fine material entering by the charging pipes, *P*, is probably assisted by the air that enters when the pipes are opened. Roasted flotation concentrate does not protect the side-walls of a furnace like coarser material, as the former is extremely mobile, and will run down instead of piling up along the



ROOF OF REVERBERATORY FURNACE

walls. As the present concentration practice at Anaconda results in the production of a large proportion of very fine material, it has been decided to increase the thickness of the side-walls of the reverberatories to 2 ft. 6 in. The plan shows the method of putting on the nine-inch brick work between the ribs. As there is nothing against which to set a skewback, the structure must be arched slightly.

The construction of the ribs can be understood from

the sketch, the skewbacks being placed on top of the roof against the buckstays. The ribs are made 15 in. wide, and every second row of bricks in the rib is tied into the roof of the furnace, except where the rib lies on the sidewalls. The bonding of the rib is shown in cross-section along the line *A A*. The wedges are not driven at the crowns of the ribs till after the striking of the centres supporting the furnace-roof, as any settlement of the roof on the removal of the centres would throw a heavy stress on the rib, causing it to crack. It is not possible to give any exact spacing for the ribs on a roof, as this depends on circumstances, but it may be said, in general, that the spacing varies from 32 to 48 inches. It is best to butt them against the buckstays, but if this is not possible, owing to interfering with the charging-pipes, a plate may be placed to cover the space between two buckstays and the skewback set against the plate. The present practice at Anaconda is to put ribs, suitably spaced, over the entire length of the roof. Previously they were built on a portion of the roof only, extending about one-third the distance from the firing end.

The photograph shows the top of a furnace-roof with a rib at every buckstay.

Cost-Keeping for Small Metal Mines

By J. C. PICKERING

*The importance of keeping accurate accounts of costs at small or medium-size mines is not as well recognized as it might be. To obtain the greatest benefit from mining an operator must, among other things, have a clear accurate statement of his expenditures and income. This will entail the preparation of a suitable accounting system, supplemented by cost-sheets and contributory data. From the small independently owned 'one-man' mine, where profit and loss are determined solely by the bank balance, to the large mining corporation employing the best technical advice, with accounting and cost keeping executed in great detail, there is a wide transition.

A suitable and properly applied scheme of cost keeping will show, within limits determined by the size and complexity of the mining enterprise under consideration, the proper allocation of all operating and construction expenditures, and will enable the management to know at periodic intervals the cost of any particular item. Such information may aid largely in any general campaign of cost-cutting or in the elimination, as unpayable, of certain phases of the work.

Adequate and suitable cost-keeping methods are a direct corollary to efficient management. Both contribute largely to the success of any mining enterprise, and when combined they frequently turn failure into success. It is inconceivable that a manager can trace and promptly stop financial leaks unless he knows the detailed cost of the various operations that enter into the aggregate expenditure.

Both cost and financial statements may be so padded with insignificant details as to obscure the main issues. A cost statement applicable to all types of mines is not possible, but skeleton suggestions that may be modified to suit the requirements of individual properties can with some confidence be offered.

A mine that has no transportation difficulties, and whose product is marketable without mechanical or other treatment, should present the simplest accounting and cost-keeping problem. In contrast to this the property whose ores are complex, or distinct in type, requiring several methods of treatment, may present a difficult problem, which may possibly be further complicated by involved methods of disposing of the final mine products; this type of mining enterprise might require an elaborate system of cost-sheets and accounts.

Too much stress cannot be laid upon the necessity for properly systematizing accounts and costs during the development and equipment stages of mining properties. The information so gathered will prove valuable and necessary not only during its period of execution, but also during the life of the mine.

During the period preparatory to production, mine reserves and surface stock piles may be created, or work such as stripping, which may subsequently be a direct charge against ore extraction, may be done. The cost of doing this preparatory work should be known in order that it may be subsequently charged against ore mined.

To devise a system of cost-keeping applicable to all mines is an impossibility, but general schemes capable of adaptation are presented and will be found in this useful publication.

*Abstract from Technical Paper 223 of the U. S. Bureau of Mines, 1919.

Germany's War Sources of Sulphuric Acid

During the War, American chemists were puzzled as to the source of the enormous amount of sulphuric acid the Germans were able to secure. Information now in the hands of the U. S. Bureau of Mines shows that at no time was there any particular stringency in Germany's supply of this acid. During the early months of the War, before conventions could be made with neutral countries, large shipments of pyrite were made to Germany; in fact, the importation of pyrite into Germany continued in some volume throughout the War. This reserve built up at the beginning of the War gave Germany time to find new resources of sulphuric acid. A noteworthy development of the Meggen pyrite took place and other pyritic beds were opened in Germany and Hungary. Considerable sulphur was obtained from Asia Minor. In addition, Germany made important use of its rich beds of blende and galena, finding means to eliminate the lead-dust that has been a source of trouble in the contact process of manufacture. Kaiserite and plaster of paris also were sources of sulphuric acid, and some sulphur was obtained by purifying gas at coke-plants. As a matter of fact, sulphuric acid was so plentiful in Germany near the close of the War that restrictions on its use by industries were rapidly being lifted.

Sulman & Picard v. Wolf

*In the High Court of Justice.
Chancery Division

Royal Courts of Justice
Saturday, 20th May, 1905

Judgment

Mr. Justice Buckley: I need not trouble you Mr. Bousfield.†

The plaintiffs sue for a sum of £166.16.3, for work and labor done, and for services rendered and moneys paid for the defendant. The claim divides itself into three parts, which I may take in the reverse order: the last is £4.4.3, which is not disputed; the last but one is £150, which is the sum agreed to be paid by an agreement contained in writing in letters of the 19 and 22nd February, 1904; and the first is a sum of £12.12.0 for certain work done in October and December, 1903. As regards the £150, that is quite plainly payable under the letters of February 1904 if the services have been rendered. The only possible contention against that is that the work was not properly done, which I will not dispose of under this head as I shall have something to say about it on the counter-claim. In my judgment that £150 is entitled to be recovered by the plaintiffs. They did the work and they have, therefore, become entitled to be paid the money agreed to be paid.

That leaves only the first item, or rather the first two items of £5.5.0 and £7.7.0. As to those the only point is this: the defendant says that as regards the sum of £12.12.0, which he does not dispute is a fair sum—I think it was said to be an agreed sum—there was some bargain that he should not be asked to pay it until a man named Johnson, who was putting up some plant, had solved certain difficulties as regards the plant. The plaintiffs say nothing of the sort took place. There was no connection at all as a matter of good sense and good reason between the fact that the plaintiffs had made the inspection, which they did make, and that Johnson, the contractor employed to make the plant, had not done what he ought to have done: there is no reason why there should have been such a bargain, and upon the evidence I arrive at the conclusion that there was not such a bargain. It is a small matter and, at most, I think the result of the evidence is that the plaintiffs said that inasmuch as Johnson's difficulties, it was thought, would have been settled in a few days, they were not going to ask for immediate payment. Something of that sort might have been said, though I do not think it was; but, at any rate, there was no bargain to postpone the payment indefinitely. I may say that when the account was sent in, which it was in April 1904, no complaint of any sort or kind was made as to any of the matters which are complained of now; and there are letters on the 4th May, 16th May, 2nd June, 14th June, 28th June, and 8th July all asking for payment, in answer to none of which was any sort of complaint set up; the defendant simply did not pay. Ultimately the writ was issued, and it was necessary to obtain an order for substituted service. There was no complaint made at all till the counter-claim came in in this action. I arrive at the conclusion, therefore, that the claim is sustained, and there must be judgment for £166.16.3, unless something arises upon the counter-claim.

I may say, however, before parting with it, that in another action which has been brought by Johnson, the maker of the plant, against Wolf, the defendant in this action, for the amount payable for the plant, Wolf counter-claims against Johnson for £166.6.8, which is the same as this sum with a trifling difference of a few shillings, as being the amount properly payable by him to the plaintiffs in this action.

Really the substantial contest between the parties does not arise upon the claim, but upon the counter-claim, and that is a more serious matter because it is an attack upon the character of the plaintiffs. Broadly stated, the case which the counter-claim seeks to set up is this: that the plaintiffs were dishonest in their dealings with the defendant; that, being employed by him to investigate a certain process, they acquired information in the course of their employment and, to put it in a short and crisp way, they stole that which belonged to him, appropriated it to themselves, and took out certain patents in respect of certain discoveries which they had found for him, and which they ought to have kept for him. Now is that true? Before approaching the fact as regards that I desire to say this, that from the first the defendant was perfectly well aware that these people were employed by other people to investigate similar processes. They appear to be gentlemen of eminence in their profession who were engaged, not only for Mr. Wolf but for other people, investigating processes similar to this. There is a letter before he first instructed them, namely on the 15th November 1902, in which they add by way of postcript, "We think it right to acquaint you with the fact that we are now advising other parties on another oil process which, however, is essentially different to your own." So they frankly tell him from the first that he was not the only employer upon processes of this description.

The next date which I have noted is the 15th September, 1903—that is to say, before the particular matters which are the subject of charge here in the claim had been undertaken by the plaintiffs, which comes from the defendant's diary. I have not got a copy of the diary,

*For explanation, see editorial page.
†Counsel for plaintiffs.

but the substance of my note about it is this, that Sulman, one of the plaintiffs, then told him that he was interested in one of these other processes, the Cattermole process, outside his professional interest. As I will state presently, the fact was that the firm had an interest in that process. He was told on the 15th September 1903 that they had a commercial interest in that process, as distinguished from the mere interest of being employed to investigate it. On the 19th February 1904 there is a letter which seems to me honest in every particular, in which they told him before they were going to resume work for him, the work which was the subject of the £150 claim in the writ: "Since writing to you on the 23rd ult., certain information has come to us, which, in view of your present proposal, we think it only right that we should put before you. Our information is in connection with another oil process which you are aware we were investigating. This process has recently made considerable progress and though we are not free to give you any details of it, we are of opinion that it will be a most serious competitor to you and will, we think eventually prove itself superior to any existing process based on the use of oil." Then they go on to say, "in view of our opinion of its probably proving superior we do not feel justified in accepting fees from you for developing your process without first giving such information and opinion as the above. We should therefore suggest to you that you might prefer to engage the assistance of some other firm to carry out your proposed trials," and so on. Then they go on to say: If you are minded still to employ us our terms will be, so and so. In the 22nd February he wrote back in that state of things "I have to thank you for your letter of the 19th inst., and am quite content that the work should proceed on the footing of our existing agreement as modified by that letter." I think the position as between the plaintiffs and the defendant a perfectly honest one. They were engaged upon other similar processes and they told him so. They told him it was competing with his: they told him they had an interest in it other than their professional interest, and he says, "Never mind, you are the best men for my work. I wish to employ you." They were employed, and he now declines to pay them. Now he says under Article 4 of the agreement of February 1903 which they entered into with him when this business was initiated, that they were bound, as they were, to give him the benefit of all discoveries, inventions, designs, and improvements from time to time discovered, made, or worked out or in course of investigation or experiment by the plaintiffs or their assistants in connection with the said process or system; so that if in their investigations for him they came across something valuable, he was to have the benefit of it. I now want to state in general terms why I am of opinion that they have done nothing at all in breach of that obligation as between them and him. In order to do that I must describe as shortly as I can, not what actually the nature of the two processes was, but what the diversity between the two processes was. There is a process of dealing with oils called the Elmore process, which for my purpose is sufficiently described by saying that it consists in so dealing with powdered ore—a system, therefore of broken rock and sand, I may call it—and metallic particles by the introduction of water and oil as that the sand shall become loaded with water, and shall sink, and the metal shall become engaged by the oil and shall float. It is a process by which the oil is separated from the sand or gangue by flotation of heavier material, namely the mineral, by it being supported by what I may describe as little rafts of oil. The process in which Wolf was interested was a process of that description. It was of the Elmore type, which was the subject of a patent by one Scammell. Scammell's improvement upon the Elmore process, I gather, was this, that he found by treating the oil with chloride of sulphur he was able to increase the viscosity and cohesion of the materials, and he got a better result in treating his minerals with oil by employing chloride of sulphur in certain proportions with the oil with which he was going to make it. That was the nature of the Scammell process, which was the process in which Wolf was interested; and therefore what the plaintiffs were employed by Wolf to do was to find out all about improvements in a system by which the mineral was to be separated from the gangue by flotation by the use of oil treated with chloride of sulphur. Well, they investigated that, and there are a number of reports which have been read; the result was that ultimately a patent was taken out of the defendant, Wolf's method, No. 4793 of 1904. The patent is for this oil and chloride of sulphur process, and the object to be attained is flotation in the way in which I have described: but it also comprised this, on which reliance has been placed, that after you have dealt with the pulp and separated your gangue from your mineral with the result that the gangue is at the bottom and the mineral at the top, the gangue was allowed to pass out of the foot or at the bottom of the spitzkasten, or the vessel in which it was treated, into a tank which is marked 'L' in the Wolf patent. On the Wolf specification you will find that the object of 'L' was this: it was so made that you got in 'L' sand mixed with oil and as they did not want to waste their oil and they wanted to get the oil out of the sand again, in order to do that there was introduced a current of air into the bottom of tank 'L' which was driven up through the oil-laden sand with the result that that drove the oil to the top and you recovered the oil; and the Wolf patent in its fourth claim claims this "in separating mineral constituents of oil from gangue by means of oil recovering oil from the waste pulps by blowing up through them currents of air with or without steam substantially as described." It is quite true that in those tailings there might be some portion of mineral also; it depended upon how efficiently you conducted your process whether there was much or little, and if there was a little you might get some of it back with the oil. But that was not the object of Wolf's patent; the object of Wolf's patent was to recover the oil, and, mark you, to recover the oil by blowing up through the tailings currents of air. That is a sufficient

description of the thing in which Wolf was interested.

Now the other matter which the plaintiffs were investigating was a different system altogether; it was the Cattermole process. Now Cattermole's process was this: he intended to use a very small quantity of oil. He begins by saying that hitherto the proportion of oil used has been so great that the mineral matter adhering to the oil floats. He says, "I am not going to do that: I am going to use a very small quantity of oil, and my object is that my mineral shall not float but shall sink, and I intend to recover it in this way: I am going to use oil emulsified with water preferably with the addition of an emulsifying agent such as soap," and he says: "I find if I do that I take care not to get oil enough to float the mineral. I let my mineral sink, and my emulsifying agent, the soap, has an effect by which the mineral becomes agglomerated or granulated by the oil which adheres in the form of a thin film to the metallic constituents which sink." So the essential difference between these two is that Scammell and Wolf send the material upwards by flotation by the oil, and Cattermole, by the things which he is going to describe, acting upon it makes the mineral with the oil go down, and they are to be found at the bottom of the pan in which it is treated. There were two patents of Cattermole's 22695 and 22696 of 1902 which describe a process of that description. Now this is the other process which the plaintiffs were treating and which the defendant Wolf has been told they had an interest other than a professional interest in. There was another patent of Cattermole's No. 17109 of 1903, and ultimately there was a patent which was introduced by amendment two or three weeks ago, I thing it is, in the Pleadings which has been relied upon, No. 20419 of 1903 of Sulman & Picard, the plaintiffs. The idea is the same in this sense, that the process now which has to be used, instead of emulsifying your oil, using a very small quantity of oil and an emulsifying agent, and agglomerating your mineral at the bottom, Sulman & Picard devised this idea; spray into your mineral which is to be treated, oil in minute globules, and also use air, and you will find that the little globules of oil having an affinity for the mineral will engage the mineral, and that little bubbles of air or gas will attach themselves to the oily surface of the mineral, the result of which will be that you will get flotation. You will no longer have a Cattermole sinkage; you will get a flotation, but a flotation by a totally different idea and process to that which was involved in the Elmore and Scammell processes. This is not flotation by oil at all, but flotation by the use of a small quantity of oil, with the result that you get bubbles of air or gas attached, and thus you get flotation by air and not flotation by oil. That is a claim which is totally and radically different, as it seems to me, to anything involved in the Scammell process. Now how is that in any way within Article 4 of this agreement as something which is found out in connection with the said process or system, that is to say the Scammell process or system? It had nothing to do with it. It was a different matter altogether. Then says the defendant: "But here you are using the system of a jet, and a jet is used in my tank 'L', and therefore you ought to give me as an improvement, or as a further development of the idea in my tank 'L' your idea of using the jet so as to get flotation by oil." To my mind there is no connection between the two. The only point of resemblance is that they both use a jet, but the object of the jet in Wolf's process was by the insertion of a jet of air to dislocate, agitate, or interfere with a mixed mass of sand and oil for the purpose of driving out the oil; it was to recover the oily matter from the tailings. The object in the Sulman & Picard patent was not at that stage of the process at all. It was a process by which not the oil was to be recovered which had been left in the tailings, but by which the mineral was to be engaged and caused to float and be separated from the gangue; and I confess I do not understand how it could be said that these gentlemen by discovering that which is said to have originated by the dropping of a grape, which had been touched by a greasy finger, into a glass of champagne—that in that they were making use for their own purposes of anything whatever which was connected with the process which they were investigating for the defendant. Having said that, I do not know that I need go on and investigate all these various matters which have been dealt with in the evidence. It is quite plain that Mr. Wolf is a person whom I may venture to say is of a nervous and suspicious frame of mind. Of course, I ought also to say that the plaintiffs have some reason for complaint in that, if he thought at any time they were not treating him fairly, he did not go and tell them so.

There is an entry in his diary on the 19th February, which is the date when this letter was written to him telling him about this competition, which shows that his mind was then in a state of suspicion and he was expecting something of the kind; but, notwithstanding that, he instructed them to go on and act for him. He says further there was some default on their part as regards the use of this Roumanian oil in the process they carried out for him. The result of the evidence as to that seems to me to be that this Roumanian oil was, for the purposes of the laboratory experiments, effective; nobody denies it. When they came to use the process with the plant which Johnson had put up, or was putting up, whether by reason of some defect in the plant, or by reason of the fact that the Roumanian oil was not the best thing to be used, it did not succeed; but there is nothing in that to show that they did not render their services to the best of their ability in the work they had to do.

The result, therefore, at which I arrive is this, that there must be judgment on the claim for £168.16.3 with costs and the counter-claim I dismiss with costs.

THERE ARE 200 engineering societies in the United States, with a total membership of 100,000, the annual dues amounting to $1,000,000. There are possibly 200 other societies more or less connected with engineering, and having many engineers as members. Probably 100,000 other engineers do not belong to any society.

A Safe Stair-Tread

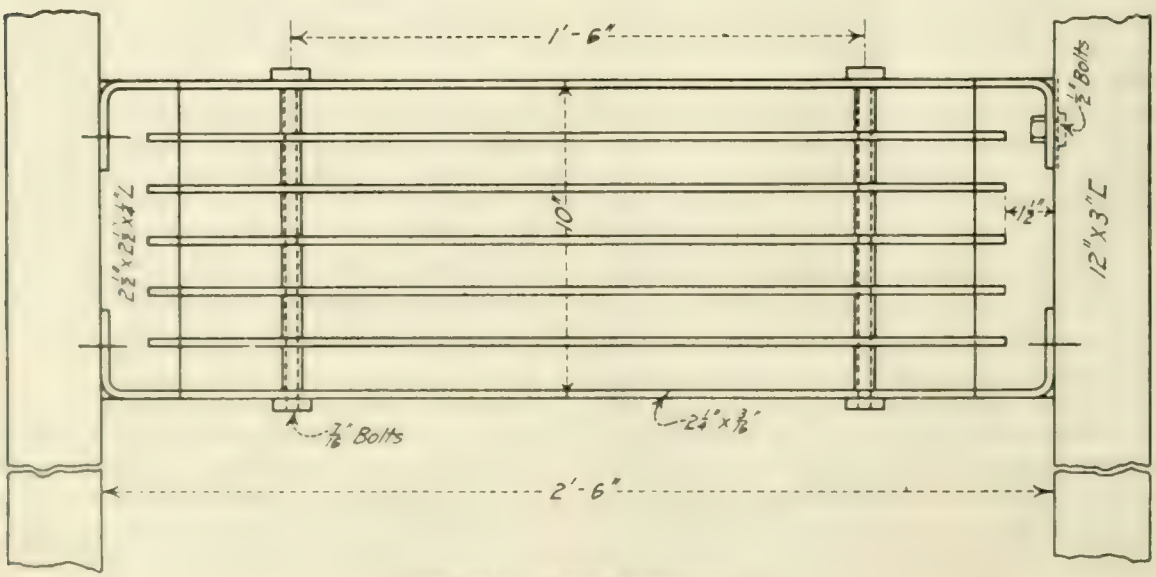
STAFF CORRESPONDENCE

The accompanying illustration shows the design of a stair-tread having several good points. Steel stairways are a usual feature about smelting works, but it is not every design that can be qualified as being safe under out-door conditions. Usually, stair-treads consist either of a channel filled with concrete, or of a casting having a raised checkered surface to give a grip to the foot. Both these types collect dirt, flue-dust, mud, and snow if placed out of doors, all of which tend to make a stairway unsafe. Ice, of course, is the greatest danger on stairs, and the only remedy for it is vigilance on the part of the 'Safety First' men, so that no water be allowed to drip where it may freeze on a stair.

A SAFE STAIR-TREAD

The grid type shown herewith seems specially adapted for outside use, as no snow can collect on it, while muddy feet tend to be automatically scraped in ascending. Although the grid stair-tread is not a novelty, this particular design is neat and simple. As shown in the sketch, besides being bolted to the outside channels, the grid is supported at the ends by angles rivetted to these channels. The several bars of $2\frac{1}{4}$ by $\frac{3}{16}$-in. iron forming the stair-tread are kept in equal spacing by pipe distance-pieces slipped on the $\frac{7}{16}$-in. bolts.

HOPE OF SUPPLYING the world's requirements for platinum rests largely with Colombia. Extraction in the Urals probably is at a practical standstill, owing to unsettled conditions in Russia. Furthermore, trend of production for years immediately preceding the War would indicate the peak of production there had been passed. Colombia has gradually increased her output from 10,000 troy ounces in 1910 to approximately 50,000. It is estimated that with new developments in operation, she will be able to produce at least 75,000 ounces per year. As the alluvial deposits along the river-beds of Colombia have been little worked for platinum, and other large areas have not been worked at all, it is probable production can be gradually increased and that the peak will not be reached for some time. In the past, interest has been centred on gold rather than on platinum in Colombia. Total known supply of platinum produced to date has been estimated at 5,000,000 to 10,000,000 troy ounces.



DETAILS OF SAFE STAIR-TREAD

Full Text of the Revised Covenant of the League of Nations

[Changes From Original Draft Are Indicated in Italics]

PREAMBLE

In order to promote international co-operation and to achieve international peace and security, by the acceptance of obligations not to resort to war, by the prescription of open, just, and honorable relations between nations, by the firm establishment of the understandings of international law as to actual rule of conduct among Governments, and by the maintenance of justice and a scrupulous respect for all treaty obligations in the dealings of organized peoples with one another, the high contracting parties agree to this covenant of the League of Nations.

[*In the original preamble the last sentence read, "adopt this constitution," instead of "agreed to this covenant."*]

ARTICLE I.

The original members of the League of Nations shall be those of the signatories which are named in the annex to this covenant and also such of those other States named in the annex as shall accede without reservation to this covenant. Such accessions shall be effected by a declaration deposited with the Secretariat within two months of the coming into force of the covenant. Notice thereof shall be sent to all other members of the League.

Any fully self-governing State, dominion, or colony not named in the annex may become a member of the League if its admission is agreed to by two-thirds of the Assembly, provided that it shall give effective guarantees of its sincere intention to observe its international obligations, and shall accept such regulations as may be prescribed by the League in regard to its military and naval forces and armaments.

Any member of the League may, after two years' notice of its intention so to do, withdraw from the League, provided that all its international obligations and all its obligations under this covenant shall have been fulfilled at the time of its withdrawal.

[*This article embodies the old Article VII. The first paragraph is new. In view of the insertion of the covenant in the peace treaty, specific provision as to the signatories of the treaty, who would become members of the League, and also as to neutral States to be invited to accede to the covenant, were obviously necessary. The paragraph also provides for the method by which a neutral State may accede to the covenant. The third paragraph of Article I is new, providing for the withdrawal of any member of the League on a notice given of two years. No mention of withdrawal was made in the original document.*]

ARTICLE II.

The action of the League under this covenant shall be effected through the instrumentality of an Assembly and of a Council, with a permanent Secretariat.

[*Originally this was a part of Article I. It gives the name Assembly to the gathering of representatives of the members of the League, formerly referred to merely as "the body of delegates."*]

ARTICLE III.

The Assembly shall consist of representatives of the members of the League.

The Assembly shall meet at stated intervals and from time to time, as occasion may require, at the seat of the League or at such other place as may be decided upon.

The Assembly may deal at its meetings with any matter within the sphere of action of the League or affecting the peace of the world.

At meetings of the Assembly each member of the League shall have one vote, and may have not more than three representatives.

[*This embodies parts of the original Articles I, II, and III, with only minor changes. It refers to "members of the League" where the term "high contracting parties" originally was used, and this change is followed throughout the revised draft.*]

ARTICLE IV.

The Council shall consist of representatives of the United States of America, of the British Empire, of France, of Italy, and of Japan, together with representatives of four other members of the League. These four members of the League shall be selected by the Assembly from time to time in its discretion. Until the appointment of the representatives of the four members of the League first selected by the Assembly, representatives of (blank) shall be members of the Council.

With the approval of the majority of the Assembly, the Council may name additional members of the League whose representatives shall always be members of the Council; the Council with like approval may increase the number of members of the League to be selected by the Assembly for representation to the Council.

The Council shall meet from time to time as occasion may require, and at least once a year, at the seat of the League, or at such other place as may be decided upon.

The Council may deal at its meetings with any matter within the sphere of action of the League or affecting the peace of the world.

Any member of the League not represented on the Council shall be invited to send a representative to sit as

a member at any meeting of the Council during the consideration of matters specially affecting the interests of that member of the League.

At meetings of the Council each member of the League represented on the Council shall have one vote, and may have not more than one representative.

This embodies that part of the original Article III designating the original members of the Council. The second paragraph is new, providing for a possible increase in the Council should other powers be added to the League of Nations whose present accession is not anticipated. The two last paragraphs are new, providing specifically for one vote for each member of the League in the Council, which was understood before, and providing also for one representative of each member of the League.]

ARTICLE V.

Except where otherwise expressly provided in this covenant, or by the terms of this treaty, decisions at any meeting of the Assembly or of the Council shall require the agreement of all the members of the League represented at the meeting.

All matters of procedure at meetings of the Assembly or of the Council, the appointment of committees to investigate particular matters, shall be regulated by the Assembly or by the Council and may be decided by a majority of the members of the League represented at the meeting. The first meeting of the Assembly and the first meeting of the Council shall be summoned by the President of the United States of America.

[*The first paragraph requiring unanimous agreement in both Assembly and Council, except where otherwise provided, is new. The phrase "or by the terms of this treaty" was an alteration proposed by President Wilson in moving the adoption of the covenant, to make it conform to the peace treaty proviso of a majority vote. The second paragraph was originally included in Article IV.*]

ARTICLE VI.

The permanent Secretariat shall be established at the seat of the League. The Secretariat shall comprise a Secretary General and such secretaries and staff as may be required.

The first Secretary General shall be the person named in the annex; thereafter the Secretary General shall be appointed by the Council, with the approval of the majority of the Assembly.

The secretaries and the staff of the Secretariat shall be appointed by the Secretary General, with the approval of the Council.

The Secretary General shall act in that capacity at all meetings of the Assembly and of the Council.

The expenses of the Secretariat shall be borne by the members of the League in accordance with the apportionment of the expenses of the International Bureau of the Universal Postal Union.

[*This replaces the original Article V. In the original the appointment of the first Secretary General was left to the Council, and approval of the majority of the Assembly was not required for subsequent appointments.*]

ARTICLE VII.

The seat of the League is established at Geneva.

The Council may at any time decide that the seat of the League shall be established elsewhere.

All positions under or in connection with the League, including the Secretariat, shall be open equally to men and women.

Representatives of the members of the League and officials of the League, when engaged on the business of the League, shall enjoy diplomatic privileges and immunities.

The buildings and other property occupied by the League or its officials, or by representatives attending its meetings, shall be inviolable.

[*Embodying parts of old Articles V and VI, this article names Geneva instead of leaving the seat of the League to be chosen later, and adds the provision for changing the seat in the future. The third paragraph, opening positions to women equally with men, is new.*]

ARTICLE VIII.

The members of the League recognize that the maintenance of a peace requires the reduction of national armaments to the lowest point consistent with the national safety and the enforcement by common action of international obligations.

The Council, taking account of the geographical situation and circumstances of each State, shall formulate plans for such reduction for the consideration and action of the several Governments.

Such plans shall be subject to reconsideration and revision at least every ten years.

After these plans shall have been adopted by the several Governments, limits of armaments therein fixed shall not be exceeded without the concurrence of the Council.

The members of the League agree that the manufacture by private enterprise of munitions and implements of war is open to grave objections. The Council shall advise how the evil effects attendant upon such manufacture can be prevented, due regard being had to the necessities of those members of the League which are not able to manufacture the munitions and implements of war necessary for their safety.

The members of the League undertake to interchange full and frank information as to the scale of their armaments, their military and naval programs and the condition of such of their industries as are adaptable to warlike purposes.

[*This covers the ground of the original Article VIII, but is rewritten to make it clearer that armament reduction plans must be adopted by the nations affected before they become effective.*]

ARTICLE IX.

A permanent commission shall be constituted to advise the Council on the execution of the provisions of Articles I and VIII and on military and naval questions generally.

[*Unchanged except for the insertion of the words "Article I."*]

ARTICLE X.

The members of the League undertake to respect and preserve as against external aggression the territorial integrity and existing political independence of all members of the League. In case of any such aggression or in case of any threat or danger of such aggression, the Council shall advise upon the means by which this obligation shall be fulfilled.

[*Virtually unchanged.*]

ARTICLE XI.

Any war or threat of war, whether immediately affecting any of the members of the League or not, is hereby declared a matter of concern to the whole League, and the League shall take any action that may be deemed wise and effectual to safeguard the peace of nations. In case any such emergency should arise, the Secretary General shall, on the request of any member of the League, forthwith summon a meeting of the Council.

It is also declared to be the fundamental right of each member of the League to bring to the attention of the Assembly or of the Council any circumstance whatever affecting international relations which threatens to disturb either the peace or the good understanding between nations upon which peace depends.

[*In the original it was provided that the "high contracting parties reserve the right to take any action," &c., where the revised draft reads, "The League shall take any action."*]

ARTICLE XII.

The members of the League agree that if there should arise between them any dispute likely to lead to a rupture they will submit the matter either to arbitration or an inquiry by the Council, and they agree in no case to resort to war until three months after the award by the arbitrators or the report by the Council.

In any case under this article the award of the arbitrators shall be made within a reasonable time, and the report of the Council shall be made within six months after the submission of the dispute.

[*Virtually unchanged except that some provisions of the original are eliminated for inclusion in other articles.*]

ARTICLE XIII.

The members of the League agree that whenever any dispute shall arise between them which they recognize to be suitable for submission to arbitration and which cannot be satisfactorily settled by diplomacy, they will submit the whole subject matter to arbitration. Disputes as to the interpretation of a treaty, as to any question of international law, as to the existence of any fact, which, if established, would constitute a breach of any international obligation, or as to the extent and nature of the reparation to be made for any such breach, are declared to be among those which are generally suitable for submission to arbitration. For the consideration of any such dispute the court of arbitration to which the case is referred shall be the court agreed on by the parties to the dispute or stipulated in any convention existing between them.

The members of the League agree that they will carry out in full good faith any award that may be rendered and that they will not resort to war against a member of the League which complies therewith. In the event of any failure to carry out such an award, the Council shall propose what steps should be taken to give effect thereto.

[*This article shows a few minor changes. But the second sentence is new, inasmuch as it undertakes to give instances of disputes which are generally suitable for submission to arbitration, instances of what have latterly been called 'justiciable" questions.*]

ARTICLE XIV.

The Council shall formulate and submit to the members of the League for adoption plans for the establishment of a permanent court of international justice. The court shall be competent to hear and determine any dispute of an international character which the parties thereto submit to it. The court may also give an advisory opinion upon any dispute or question referred to it by the Council or by the Assembly.

[*Unchanged except for the addition of the last sentence.*]

ARTICLE XV.

If there should arise between members of the League any dispute likely to lead to a rupture, which is not submitted to arbitration as above, the members of the League agree that they will submit the matter to the Council. Any party to the dispute may effect such submission by giving notice of the existence of the dispute to the Secretary General, who will make all necessary arrangements for a full investigation and consideration thereof. For this purpose the parties to the dispute will communicate to the Secretary General, as promptly as possible, statements of their case, all the relevant facts and papers; the Council may forthwith direct the publication thereof.

The Council shall endeavor to effect a settlement of any dispute, and if such efforts are successful, a statement shall be made public, giving such facts and explanations regarding the dispute and terms of settlement thereof as the Council may deem appropriate.

If the dispute is not thus settled, the Council either unanimously or by a majority vote shall make and publish a report containing a statement of the facts of the dispute and the recommendations which are deemed just and proper in regard thereto.

Any member of the League represented on the Council may make public a statement of the facts of the dispute and of the conclusions regarding the same.

If a report by the Council is unanimously agreed to by the members thereof other than the representatives of one or more of the parties to the dispute, the members of the League agree that they will not go to war with any

party to the dispute which complies with the recommendations of the report.

If the Council fails to reach a report which is unanimously agreed to by the members thereof, other than the representatives of one or more of the parties to the dispute, the members of the League reserve to themselves the right to take such action as they shall consider necessary for the maintenance of right and justice.

If the dispute between the parties is claimed by one of them, and is found by the Council to arise out of a matter which by international law is solely within the domestic jurisdiction of that party, the Council shall so report and shall make no recommendations as to its settlement.

The Council may in any case under this article refer the dispute to the Assembly. The dispute shall be so referred at the request of either party to the dispute, provided that such request be made within fourteen days after the submission of the dispute to the Council.

In any case referred to the Assembly all the provisions of this article and of Article XII relating to the action and powers of the Council shall apply to the action and powers of the Assembly, provided that a report made by the Assembly, if concurred in by the representatives of those members of the League represented on the Council and of a majority of the other members of the League, exclusive in each case of the representatives of the parties to the dispute, shall have the same force as a report by the Council concurred in by all the members thereof other than the representatives of one or more of the parties to the dispute.

[*The seventh paragraph specifically excluding matters of "domestic jurisdiction" from action by the Council is new. In the last sentence the words "if concurred in by the representatives of those members of the League represented on the Council," &c., have been added.*]

ARTICLE XVI.

Should any member of the League resort to war in disregard of its covenants under Articles XII, XIII, or XV, it shall ipso facto be deemed to have committed an act of war against all other members of the League, which hereby undertake immediately to subject it to the severance of all trade or financial relations, the prohibition of all intercourse between their nationals and the nationals of the covenant-breaking State, and the prevention of all financial, commercial, or personal intercourse between the nationals of the covenant-breaking State and the nationals of any other State, whether a member of the League or not.

It shall be the duty of the Council in such case to recommend to the several Governments concerned what effective military or naval forces the members of the League shall severally contribute to the armaments of forces to be used to protect the covenants of the League.

The members of the League agree, further, that they will mutually support one another in the financial and economic measures which are taken under this article, in order to minimize the loss and inconvenience resulting from the above measures, and that they will mutually support one another in resisting any special measures aimed at one of their number by the covenant-breaking State and that they will take the necessary steps to afford passage through their territory to the forces of any of the members of the League which are co-operating to protect the covenants of the League.

Any member of the League which has violated any covenant of the League may be declared to be no longer a member of the League by a vote of the Council concurred in by the representatives of all the other members of the League represented thereon.

[*Unchanged except for the addition of the last sentence, providing for an expulsion from the League under certain extraordinary circumstances.*]

ARTICLE XVII.

In the event of a dispute between a member of the League and a State which is not a member of the League, or between States not members of the League, the State or States not members of the League shall be invited to accept the obligations of membership in the League for the purpose of such dispute, upon such conditions as the Council may deem just. If such invitation is accepted, the provisions of Articles XII to XVI, inclusive, shall be applied with such modifications as may be deemed necessary by the Council.

Upon such invitation being given, the Council shall immediately institute an inquiry into the circumstances of the dispute and recommend such action as may seem best and most effectual in the circumstances.

If a State so invited shall refuse to accept the obligations of membership in the League for the purposes of such dispute, and shall resort to war against a member of the League, the provisions of Article XVI shall be applicable as against the State taking such action.

If both parties to the dispute, when so invited, refuse to accept the obligations of membership in the League for the purposes of such dispute, the Council may take such measures and make such recommendations as will prevent hostilities and will result in the settlement of the dispute.

[*Virtually unchanged.*]

ARTICLE XVIII.

Every convention or international engagement entered into henceforward by any member of the League shall be forthwith registered with the Secretariat, and shall, as soon as possible, be published by it. No such treaty or international engagement shall be binding until so registered.

[*Same as original Article XXIII.*]

ARTICLE XIX.

The Assembly may, from time to time, advise the reconsideration by members of the League of treaties which have become inapplicable, and the consideration of international conditions whose continuance might endanger the peace of the world.

[*Virtually the same as original Article XXIV.*]

ARTICLE XX

The members of the League severally agree that this covenant is accepted as abrogating all obligations or understandings inter se which are inconsistent with the terms thereof, and solemnly undertake that they will not hereafter enter into any engagements inconsistent with the terms thereof.

In case a member of the League shall, before becoming a member of the League, have undertaken any obligations inconsistent with the terms of this covenant, it shall be the duty of such member to take immediate steps to procure its release from such obligations.

[*Virtually the same as original Article XXV.*]

ARTICLE XXI.

Nothing in this covenant shall be deemed to affect the validity of international engagements such as treaties of arbitration or regional understandings like the Monroe Doctrine for securing the maintenance of peace.

[*Entirely new.*]

ARTICLE XXII.

To those colonies and territories which as a consequence of the late war have ceased to be under the sovereignty of the States which formerly governed them, and which are inhabited by peoples not yet able to stand by themselves under the strenuous conditions of the modern world, there should be applied the principle that the well being and development of such peoples form a sacred trust of civilization, and that securities for the performance of this trust should be embodied in this covenant.

The best method of giving practicable effect to this principle is that the tutelage of such peoples be intrusted to advanced nations who, by reason of their resources, their experience, or their geographical position, can best undertake this responsibility, and who are willing to accept it, and that this tutelage should be exercised by them as mandataries on behalf of the League.

The character of the mandate must differ according to the stage of development of the people, the geographical situation of the territory, its economic condition and other similar circumstances. Certain communities formerly belonging to the Turkish Empire have reached a stage of development where their existence as independent nations can be provisionally recognized subject to the rendering of administrative advice and assistance by a mandatary until such time as they are able to stand alone. The wishes of these communities must be a principal consideration in the selection of the mandatary.

Other peoples, especially those of Central Africa, are at such a stage that the mandatary must be responsible for the administration of the territory under conditions which will guarantee freedom of conscience or religion subject only to the maintenance of public order and morals, the prohibition of abuses such as the slave trade, the arms traffic, and the liquor traffic, and the prevention of the establishment of fortifications or military and naval bases and of military training of the natives for other than police purposes, and the defense of territory, and will also secure equal opportunities for the trade and commerce of other members of the League.

There are territories, such as Southwest Africa and certain of the South Pacific islands, which, owing to the sparseness of their population or their small size or their remoteness from the centres of civilization or their geographical contiguity to the territory of the mandatary and other circumstances can be best administered under the laws of the mandatary as integral portions of its territory, subject to the safeguards above mentioned in the interests of the indigenous population. In every case of mandate, the mandatary shall render to the Council an annual report in reference to the territory committed to its charge.

The degree of authority, control, or administration to be exercised by the mandatary, if not previously agreed upon by the members of the League, shall be explicitly defined in each case by the Council.

A permanent commission shall be constituted to receive and examine the annual reports of the mandataries and to advise the Council on all matters relating to the observance of the mandates.

[*This is the original Article XIX virtually unchanged, except for the insertion of the words "and who are willing to accept," in describing nations to be given mandates, thus explicitly introducing the principle that a mandate cannot be forced upon a nation unwilling to accept it.*]

ARTICLE XXIII.

Subject to and in accordance with the provisions of international conventions existing or hereafter to be agreed upon, the members of the League (a) will endeavor to secure and maintain fair and humane conditions of labor for men, women, and children, both in their own countries and in all countries to which their commercial and industrial relations extend, and for that purpose will establish and maintain the necessary international organizations; (b) undertake to secure just treatment of the native inhabitants of territories under their control; (c) will intrust the League with the general supervision over the execution of agreements with regard to the traffic in women and children, and the traffic in opium and other dangerous drugs; (d) will intrust the League with the general supervision of the trade in arms and ammunition with the countries in which the control of this traffic is necessary in the common interest; (e) will make provision to secure and maintain freedom of communication and of transit and equitable treatment for the commerce of all members of the League. In this connection the special necessities of the regions devastated during the war of 1914-18 shall be in mind; (f) will endeavor to take steps in matters of international concern for the prevention and control of disease.

[*This replaces the original Article XX, and embodies parts of the original Articles XVIII and XXI. It elim-*

[notes a specific provision formerly made for a bureau of labor and adds the clauses (b) (c) and (f) respectively providing for the just treatment of aborigines, prevention of the white slave traffic and the traffic in opium, and looking toward progress in international prevention and control of disease.]

ARTICLE XXIV.

There shall be placed under the direction of the League all international bureaus already established by general treaties if the parties to such treaties consent. All such international bureaus and all commissions for the regulation of matters of international interest hereafter constituted shall be placed under the direction of the League.

In all matters of international interest which are regulated by general conventions, but which are not placed under the control of international bureaus or commissions, the Secretariat of the League shall, subject to the consent of the Council and if desired by the parties, collect and distribute all relevant information and shall render any other assistance which may be necessary or desirable.

The Council may include as part of the expenses of the Secretariat the expenses of any bureau or commission which is placed under the direction of the League.

[Same as Article XXII in the original, with the matter after the first two sentences added.]

ARTICLE XXV.

The members of the League agree to encourage and promote the establishment and co-operation of duly authorized voluntary national Red Cross organizations having as purposes the improvement of health, the prevention of disease, and the mitigation of suffering throughout the world.

[Entirely new.]

ARTICLE XXVI.

Amendments to this covenant will take effect when ratified by the members of the League whose representatives compose the Council and by a majority of the members of the League whose representatives compose the Assembly.

No such amendment shall bind any member of the League which signifies its dissent therefrom, but in that case it shall cease to be a member of the League.

[Same as the original, except that a majority of the League instead of three-fourths is required for ratification of amendments, although it does not change the requirement in that matter with regard to the vote in the Council. The second paragraph is also new, and was added at the request of the Brazilian delegation, in order to avoid certain constitutional difficulties. It permits any member of the League to dissent from an amendment, the effect of such dissent being withdrawal from the League.]

ANNEX TO THE COVENANT

I. Original members of the League of Nations.

Signatories of the Treaty of Peace:

United States of America, Belgium, Bolivia, Brazil, British Empire, Canada, Australia, South Africa, New Zealand, India, China, Cuba, Czechoslovakia, Ecuador, France, Greece, Guatemala, Haiti, Hedjaz, Honduras, Italy, Japan, Liberia, Nicaragua, Panama, Peru, Poland, Portugal, Rumania, Serbia, Siam, Uruguay.

States invited to accede to the covenant:

Argentine Republic, Chile, Colombia, Denmark, Netherlands, Norway, Paraguay, Persia, Salvador, Spain, Sweden, Switzerland, Venezuela.

II. First Secretary General of the League of Nations: [Sir Eric Drummond.]

[The annex, also a later addition, was not published with the original draft of the covenant.]

The Jones Process for Manganese Ores

The aim of the Jones process is to effect by metallurgical means a separation and consequent concentration of the manganese in ores in which the association of the manganese with iron is so intimate that ordinary methods of gravity or magnetic separation are out of the question. The process consists of two stages. In the first, called low-temperature reduction stage, two products are made, namely (*a*) metallic iron, suitable for direct use in the manufacture of steel, and (*b*) slag. Most of the manganese is concentrated in the slag. Separation of these two products is accomplished by grinding the sinter resulting from the low-temperature treatment of the ore, and thereupon extracting the magnetic iron pellets by means of magnetic separation apparatus, producing thereby a high-grade magnetic iron concentrate, and a non-metallic manganiferous sinter. Separation is also accomplished by pouring the material under treatment in a liquid condition and recovering the iron metal in the form of a button. This last method of separation was developed at the Minneapolis experiment station of the Bureau of Mines. Its advantages are obvious, and should the process become a commercial success, this method of separation would doubtless be used. The second stage, which may be called the high-temperature stage, involves the smelting of the manganiferous slag or sinter derived from the first stage, to produce a manganese alloy.

The results of tests carried out by the U. S. Bureau of Mines indicate that by the Jones process concentration of manganese in the finely disseminated manganiferous iron ores is metallurgically possible. The metal produced in the low-temperature reduction is suitable for conversion into steel by any basic steel process. It could not be used as a foundry metal. Whether the low-temperature reduction could be modified to yield a foundry metal would require further experiments. By a suitable regulation of temperature and by the use of iron ore in the place of manganiferous ores, it is possible to make a foundry metal. About 72% of the manganese in the ore appears in the alloy.—Peter Christianson and W. H. Hunter.

COLORADO

STATE MINES DEVELOPMENT ASSOCIATION.—SILVERTON, PARADOX VALLEY, RICO, TELLURIDE, OURAY, LA PLATA.

Mine-owners in south-western Colorado favor the newly organized State Mines Development Association. The objects of the association are to increase public interest and confidence in mining operations and to develop the mining resources of the State more intensively. The State will be mapped out into 10 districts, each district to be supervised by a local board of directors composed of shareholders of the association. The local board will examine any prospects brought to its attention, recommending favorable prospects for development. They will also have the management of any association projects within their district. The various operations of the association will be determined by the parent company solely upon respective merits, regardless of the district location, thus eliminating favoritism. The plan of capitalization is similar to that of insurance companies, 10-year contracts being issued to shareholders, upon which an annual assessment is paid similar to the premium on insurance policies. These contracts call for a participation in the association's profits from all sources up to 90%, the remaining 10% going to the capitalization and maintenance of the parent company. Local branches have been organized at Ouray and Silverton, and it is probable that other towns will form branches.

SILVERTON.—Shipments from this district are light, but extensive development work continues. The rising price of copper is having a stimulating effect on the operations of the smaller producers, whose output is mainly copper ores; it will especially benefit Red Mountain, as soon as the Silverton railway is again open. At present the tracks are out at numerous points, and extensive repairs are required before the ore can be pulled. Large tonnages are ready for shipment, as has been noted at an earlier date.

The Sunnyside M. & M. Co. has a force of men on the ground starting construction work on the new buildings. The Gold King Extension Mining Co. is now running the mill. The preliminary tests are encouraging, and continuous milling is to be expected. Mr. Kinney, who has been severely ill, is recovering and will soon resume the direction of the work. The Columbus mine, near Animas Forks, was obliged to discontinue operations for a short period while repairs were made to the compressor. The Rouville and the Little Anna properties will be operated under lease by Fattor and Job. The American Smelting & Refining Co. has leased the Silver Lake mine to Giono & Co., who have started operations. The Silver Ledge will resume operations. A fire at the Vernon mine, near Red Mountain, destroyed all the outside workings except the bunk-house and office-buildings, causing a loss of $100,000. The Summit Copper M. & M. Co. has resumed operations.

The Barstow mine will probably be worked on a larger scale than for years, as the orebodies recently opened up in virgin ground are promising, there being a large tonnage of high-grade gold-milling ore. The recent strike that was made by breaking open an envelope of kaolin has broken all records for richness of ore found in this mine. The Radiant Mining Co., operating in the vicinity of Burro Bridge, reports a good showing of ore on the December vein. Development on the Sioux group of claims is now under way. The Gold Bird group has a good showing of galena and copper in a newly opened vein. The North Star M. & M. Co. has resumed operations. The Highland Mary Leasing Co. is shipping steadily.

The Needle mountains, about 20 miles south of Silverton, are receiving attention, and new prospects are being opened. The most important is the Black Horse, near Needleton; this has extensive bodies of high-grade zinc-lead ore. The property is some distance from the railroad, so that packing is necessary, but as soon as increased shipments warrant the expense a wagon-road will be built.

PARADOX VALLEY.—The Radium Mines Co. is developing its holdings in the Long Park district. The Carnotite Reduction Co. intends to build a large mill for the treatment of carnotite ore. The site of the plant has not been determined upon, but it will be either in the Paradox Valley or at Grand Junction. Shortage of labor continues.

RICO.—Scarcity of labor has caused the curtailment of many operations. The Marmatite M. & M. Co. continue to mine low-grade ore, and is shipping at the rate of two cars daily. An assay-office has recently been added. The Rico Argentine Mining Co. is about to resume shipping. The Resolute Mining Co. continues to mine high-grade silver ore. Operations have been resumed upon the Expectation group, and a large body of high-grade copper ore has been opened up. In anticipation of a busy season a boarding and bunk-house will be built. The Big Four company will resume operations with the driving of a new adit into Telescope mountain. In order to facilitate the placing of miners, a clearing-house for

miners has been established, so that the needs of the various companies can be listed.

TELLURIDE.—Shipments continue light, but development work is increasing. Acute labor shortage exists, 250 men being required for all the projects planned. The Belmont-Wagner Mining Co. is now operating the Alta mill successfully, and high-grade concentrate is being shipped at the rate of a car every other day. The Inamo & Perino Leasing Co. is milling and shipping steadily.

OURAY.—Gannon & Hall are operating the Rose lode under lease, the first car of the season having been shipped during the last week in June. The holdings of the Wanakah Mining Co. are to be sold at auction to satisfy a judgment. The holdings consist of the following claims: the Sawdoff Lode, King Lode, Lilly Clay Lode, U. S. Gold Lode, and Bluff Lode.

LA PLATA.—Mining activity in Cave basin is reviving. The Excelsior mine has a good showing of silver ore, and has resumed shipments. Transportation difficulties need to be overcome, as the ore must be packed for a distance of four miles to reach the wagon-road, and from that point hauled 25 miles to the smelter.

MICHIGAN

CALUMET & HECLA, SENECA, QUINCY, ISLE ROYALE.

HOUGHTON.—Calumet & Hecla's loss by fire of the Hancock & Pewabic engine-house, with its contained hoisting plants, did not interfere seriously with ore production. The plant served four shafts on the conglomerate: No. 7, 8, 9, and 10, all in the South Hecla branch of the main Calumet & Hecla mine. Within 12 hours after the fire one of the shafts was connected with an auxiliary hoist and within 24 hours all shafts were producing ore and hoisting it at the normal rate. These four shafts are included in the program for greater development with depth that is planned for the Calumet & Hecla conglomerate lode. The haulage level to connect the Red Jacket shaft with the territory served by shafts 6 and 7 Hecla and 9 and 10 South Hecla has been driven 3700 ft. This is being driven in the amygdaloid 180 ft. under the conglomerate, and when finished will be 7800 ft. long. Connection with the conglomerate will be established by means of underground shafts. Power tramming will be used.

The Seneca shaft is below 1800 ft. and sinking continues. Driving has commenced on the first level. The cross-cut showed well-mineralized Kearsarge amygdaloid. Additional surveys of possible mill-sites have been made on that part of the Lake Superior shore line held under option. Quincy's new hoist for No. 2 plant has begun to arrive and will be installed as rapidly as possible. It is designed to hoist from a depth of 14,000 ft., as against an 8200-ft. maximum for the present plant. Isle Royale production now is limited to shafts 4, 5, and 7. The June ore tonnage was approximately 42,000 and averaged 18 lb. of copper per ton. Five drill parties are working in newer openings, all in ground which is reported to average 20 lb. over a stoping width. North of the shaft the drifts over to No. 6 are holed through down to and including the seventh level, but on the south side the drifts from the surface down to the sixth were stopped at 1200 ft., as that is the point midway to the

MAP OF MICHIGAN COPPER DISTRICT

location of the proposed No. 8 shaft. Work on this has not yet been started.

NEVADA

GOLDFIELD, AUSTIN, PIONEER, TONOPAH, KENNEDY.

GOLDFIELD.—Under supervision of F. D. Bradley, of San Francisco, the Goldfield Consolidated mill is being repaired and improved and will go into commission the first week of August. It is scheduled to treat 1200 tons of ore per day from the Red Top mine and the north section of the Florence. The Red Top product is to be hoisted through the Laguna shaft. The Combination mine is being placed in shape for early production by way of the Fraction shaft. The Goldfield Development Co. estimates, including ore exposed in the north half of the Florence mine, a minimum of 2,150,000 tons of ore available for treatment.

A new silver-lead district 10 miles south of Goldfield is attracting attention. The district formerly was known as Casey's Flats. The Merrill Silver-Lead company, owning 125 acres, has been organized, and Harry B. Ruhl, interested in a number of companies at Divide, is forming a corporation to develop claims in the new dis-

trict. The principal vein in the Merrill claims has a maximum width of six feet. Assays from 3.84 to 7.44 oz. silver have been reported. The ore also contains considerable lead and a small quantity of gold. The principal formation in the district is a dark gray crystalline limestone.

AUSTIN.—The face of the Hiawatha tunnel of the Austin Nevada Consolidated is in ore, and opening of the vein-system has begun. H. G. Richardson, the manager, reports financing of important work is proceeding satisfactorily and that the directors plan to erect the first unit of a large mill in the fall. Emmet D. Boyle, Governor of Nevada, has acquired a group of claims adjoining the Austin Nevada Consolidated and started sinking on a promising vein showing high-grade silver. The Austin Dakota Co. is reported to have opened extensive reserves of ore carrying silver. It is planned to erect a mill in the near future. C. J. Babcock, Dean of the North Dakota School of Mines, is consulting engineer, and C. F. Littrell is manager.

PIONEER.—J. B. Kendall, president of the Consolidated Mayflower, has confirmed report of a discovery of four feet of $100 gold ore on the 200-ft. level. The strike was made in a raise which had advanced 14 ft. on $40 ore. The cross-cut has struck the Mayflower vein on the 500-ft. level, showing seven feet of $15 ore. The directors have practically decided on immediate construction of a new mill, and definite action will probably be taken at the annual stockholders meeting, to be held at Pioneer on July 21.

TONOPAH.—Tonopah Extension Co. has begun diamond-drilling of the south end of Red Rock claim, adjoining the California claim of the West End company. The work will determine if the Ohio vein continues into Tonopah Extension territory. On the 1680-ft. level of the Victor shaft a station has been cut on the north side and a 500-gal. turbine pump installed. Cross-cutting is progressing from the 1700-ft. level to reach the Murray vein.

KENNEDY.—A. A. Smith and Frank Warning have uncovered a promising vein of silver-gold ore at surface and traced the orebody for 3000 ft. It ranges from three to four feet wide and has been followed to a depth of 15 ft. The ore is said to be milling grade, mingled with seams of rich quartz. Extension of the vein has been found on the Silver Butte group, owned by Lee Campbell and William Sarden.

ONTARIO

KIRKLAND LAKE, PORCUPINE, COBALT.

Forest fires swept large areas of Northern Ontario last week, and the mines of the Porcupine camp were for some time in danger. Some damage was done at the Dome Lake mine and the Hollinger and other properties in the Timmins area were seriously threatened, but were saved by a timely rainstorm. The most serious losses sustained were at Boston Creek, where the mining plants of the Patricia and Cotter were burned. The loss on the mill of the Patricia is estimated at about $75,000.

KIRKLAND LAKE.—Operations at the leading mines are at a standstill owing to the miners' strike, which is still unsettled. The majority of the strikers have left the camp, a number of them having gone out as prospectors or found employment in doing assessment work on claims. ——The Ontario Kirkland will install a 100-ton mill. A vein stated to show $28 ore, over a width of 5 ft., has been opened up on the 300-ft. level. The Greene-Kirkland company, which owns a group of claims formerly belonging to the Lucky Cross, will install a small mining plant and carry on a comprehensive program of exploration.——The output of the Lake Shore during May amounted to $42,136 from the treatment of 1750 tons of ore, running $24.08 per ton.——The Kirkland Lake has 500 tons of ore in the mine bins and a surface dump of 8000 tons with stopes full at the 300-ft. level. At the 600-ft. level a 15-ft. ore face is showing with ore stated to average $55 per ton. Running parallel is another 3-ft. orebody averaging $28 per ton. Surface work on the Young-Duncan east of the Tough-Oakes shows two good veins 3 and 5 ft. wide, which are believed to be an extension of the Tough-Oakes vein system.——At the Kirkland Combine, camps are being built and exploration work undertaken.

PORCUPINE.—The Porcupine miners recently asked the operators for an increase of 50c. per day in wages all around. It is hardly probable that the request will be granted, but the leading mines are preparing to meet the views of their employees by reducing the cost of living, by opening company stores, to a point that would be more advantageous to them than the granting of the increase asked for. The Dome Mines, it is stated, has already by this means cut down living expenses some 18% below what they were at the beginning of the year. The Hollinger is making plans in the same direction, by which it is hoped to bring about a reduction of 25%. The miners are reported to be showing a conciliatory spirit ready to co-operate with the company.

The Dome Mines is said to be producing at the rate of approximately $120,000 monthly, or at about half capacity. An average of about 20,000 tons of ore is treated every 30 days, indicating that mill-heads are running somewhat higher than the average grade of the ore. Profits are conservatively figured at about $2 per ton. ——The Imperial has let contracts for several hundred feet of driving and cross-cutting.——The McIntyre is cutting a station in the main shaft at the 1200-ft. level. Ore from the 1135-ft. level is being mined and milled. The shaft has been sunk 175 ft. deeper and a haulage level established. The mill is reported running at capacity on ore averaging $10.

COBALT.—The threatened strike of miners still hangs fire, action having been deferred pending further negotiations with the mine owners through the Labor Department of the Canadian government. Meanwhile the miners are receiving an additional bonus of 25c. per day for the month of June as a result of the quotations for silver having averaged over $1.10 per ounce during the month. This brings the total bonus paid in addition to the regular wage up to $1.50 per day.

The Foster has discovered another vein at the 40-ft. level. It is reported to be high-grade.——The Oxford-Cobalt, which has two claims in the Gillies Limit, directly south of the Kerr Lake group of mines, has appointed Prof. J. W. Russell, late of Woodstock College, as manager.——The Adanac has made its first shipment of a car of high-grade ore and concentrate.——At the Provincial three veins have been encountered, which though low grade show considerable silver in the wall-rock. On the Temiskaming a 2-in. ore-shoot carrying some high-grade has been encountered at a depth of 575 ft. The Mohawk, on the west side of Mud lake, has started work.——The Kerr Lake produced 105,582 oz. of silver during May, compared with 104,477 in April.

BRITISH COLUMBIA

GENERAL NEWS OF THE PROVINCE.

Rails have been laid on the extension of the North Fork branch of the Kettle Valley Railroad to the Rock Candy fluorspar mine, belonging to the Consolidated M. & S. Co. The siding to the Humming Bird mine also has been completed.

The work at the Big Missouri mine, Salmon River district, recently bonded to Sir Donald Mann, has been placed in charge of William Noble, who has a number of men on development work.——The Spider group, Salmon River district, has been optioned to R. W. Martin, of Seattle. Rich ore is said to have been struck recently.

Diamond drilling on the Snowstorm property, Highland valley, has found a body of high-grade copper at a depth of 600 ft. Surface ore sent to the smelter some time ago gave returns of 30% and 23% copper, respectively.

The Cunningham mill, on the Alamo claims, Slocan district, has been re-started.

Miners at the Cork Province mine, Ainsworth district, are out because the mine refused to pay the wage-scale in force at the Sandon camp. The ore is low grade, and mine-owners say they cannot pay Sandon wages and work at a profit.——The Silversmith mine, Sandon, recently shipped 100 tons of concentrate to the smelter, and received a return of 90 oz. silver per ton. In future it is expected that the mine will be shipping 300 tons of silver-lead concentrate per month.

After a considerable period during which nothing but development has been done, the Silver Standard, at New Hazelton, shipped two 44-ton cars of silver-zinc concentrate. The mine and mill are in full operation once again, and in future will be shipping about two cars of zinc and one car of lead concentrate per month. The concentrates are being sent to the Selby smelter.

A combined San Francisco and Seattle syndicate has bonded the Carmi mine, in the Boundary-Yale district. A new mill and compressor plant are to be erected.

GRAND FORKS.—The Granby Consolidated Mining, Smelting & Power Co. has discontinued operations at its Grand Forks smelter and Phoenix mine, and it is believed that the close down is permanent. Although the immediate cause of the cessation of work is lack of coke owing to the strike at the Fernie coal-fields, it is felt that this trouble only hastened what was inevitable. The company is offering all employees at Grand Forks and Phoenix free transportation to Anyox and positions with the company at that place. Among the Phoenix miners and business men, however, there is a persistent feeling that Phoenix will rise again from its Granby ashes. It is pointed out that the machinery is not being removed, the only exception being that of a few ore-crushers, and that although the Great Northern Railway will pull up its tracks, the C. P. R. will not do so. Attention in this connection is directed to the report of the Granby company of last June, which states that there was then 3,274,966 tons of ore in the Phoenix mine. Since that time it is estimated that about 150,000 tons has been mined. On that basis, therefore, there are about 3,000,000 tons still left. This, with the possibility of new development, inclines those with confidence in the camp to the belief that the Consolidated Mining & Smelting Company of Canada is likely to step into the breach and to continue mining operations in the district.

MEXICO

EXPORTS THROUGH AGUA PRIETA.—GENERAL NEWS.

SONORA.—Exports of ore through the port of Agua Prieta into the United States during the month of June showed a slight decrease from May. The total value was $1,135,600, Mexican gold, from a total of 161 cars or 6296 tons of ore. Nacozari led with 5640 tons, which represented several companies, but chiefly the output of the Moctezuma Copper Co.; El Tigre was second with 450 tons; other shippers were San Nicolas 33 tons, San Pablo 48 tons, San Pedro 16 tons, La Cruz 38 tons, Nueva Amistad 10 tons, Tarasca 21 tons, Tres Piedras 10 tons, and La Roy 30 tons.

The Babicanora mine is being opened up on three levels, exposing some good ore. A 25-ton stamp-mill is making a high-grade concentrate of silver and gold, and a zinc concentrate which is shipped to Nacozari and marketed. Sixty men are employed. Las Chispas, adjoining the Babicanora, is operating steadily, shipping high-grade ore and flotation concentrate from its mill. The Tepecate mine, south of the Babicanora, is being opened by Hosier Brothers & Co., of Kansas City, Missouri. The company is well financed and is doing consistent work reopening the old workings in this rich silver-lead mine. Twenty-five men are employed. New machinery is being set up. Recent developments underground are reported to be of encouraging nature. The Espiritu Santo, adjoining Las Chispas, will start operations soon. At present it is being examined for the owners by John A. Rice. It is controlled by a Cananea company composed of R. L. Hawes, the estate of Harry Kirk, and others. It is reported to have rich bodies of silver ore. The San Pascual property continues operating in a modest way, developing its orebodies by means of shafts and tunnels. It is in charge of Martin Hickenson. The San Nicolas, operated by Douglas capital, began operation of its new 50-ton flotation mill early in July.

ARIZONA

Globe.—The Miami Mining & Milling Co. has purchased the complete 250-ton milling plant of the Arizona Butte company from W. J. Porter of Globe. The company is now installing an initial 50-ton plant, the capacity of which is to be increased from time to time. The new compressor plant is expected to be in operation within a week.

Kingman.—It is reported that H. M. Crowther has satisfactorily financed the Arizona Butte tunnel project at Stockton Hill. Sufficient money has been raised to drive an 11,000-ft. tunnel. It is expected that this tunnel will open ore at depth under many old mines and at the same time open up new orebodies. A contract has been let to W. D. Grannis of Los Angeles to drive an adit drift on the Cedar Grannis silver vein near the Leviathan mine. This drift is now in 160 feet.

Nogales.—The Lyman Syndicate of Jerome has secured a 25 year lease from Billy Powers on the Blue Nose property, which has not been worked since 1882. A large hoist, compressor, and other machinery have recently been installed and sinking is to commence immediately.

Oatman.—It is reported that the orebody on the 1400-ft. level of the United Eastern Mining Co. has been cut and that the values are the same as those on the 660-ft. level. The shaft has lately been sunk from the 1150-ft. level to the 1400-ft. level.

Prescott.—The Silver Belt mine has made its first shipment of silver ore to El Paso. The ore is estimated to run 300 oz. of silver per ton and comes from the 300-ft. level. Driving on this level is to be continued. A pumping plant has been installed and other necessary machinery is to be ordered.

Tucson.—The Ohio Arizona Copper Co. has taken over the Silver Hill property in the Silver Bell mountains. This property has been worked spasmodically for years, being the old Nat Faison patented claims. The work, however, has never been carried on at any depth. A 400-ft. shaft is to be sunk immediately. The property is 15 miles from the railroad and smelter at Sasco.

CALIFORNIA

Alleghany.—An electric hoist has been installed in the main adit of the Mariposa, 600 ft. from the portal. Shaft-sinking to a depth of 500 ft. on the lode will be immediately carried forward. Ore of excellent milling grade is reputed in the tunnel workings. Sinking will commence shortly at the El Dorado group to seek three veins which have given fair results in the tunnel workings.

Carson Hill.—The Morgan mine, operated by the Carson Hill company, is producing from the 200, 300, 500, and 675-ft. levels and keeping the mill running at capacity on ore stated to average $12 to $13. Monthly earnings approximate $60,000, with the mill treating about 4500 tons. Total operating costs average less than $5. Before the end of July stoping will start on the 860-ft. level.

Downieville.—A new tunnel, which will be 700 ft. long, is being driven at the White Bear gravel mine. It is planned to intersect the channel 1500 ft. below the main lateral, from which the miners were recently driven by a heavy water flow. John Costa is superintendent.

Engelmine.—Prospecting outlying ground with diamond-drills has been started by the Engels Copper company.

Grass Valley.—There have been rumors of a new strike, due to dissatisfaction with some of the conditions brought about by the agreement recently entered into between the Mine Workers' Protective League and the operators, which does not seem to work out in practice as anticipated by the miners. All the mines are in operation except the Union Hill, which is stated to have closed down permanently. The State Highway Mining company, composed of local residents, is reputed to have uncovered at a depth of 50 ft. a vein assaying $50 over seven inches. The shaft will be sunk 50 ft. deeper and driving commenced.

Ingot.—The Afterthought Copper Co. officially announces that the reverberatory furnace and flotation plant will go into commission before July ends. Fifty to sixty men will be added to the working crew and underground operations increased.

Kennett.—The Mammoth Copper Co. has asked the supervisors to reduce its assessment for this year from $1,963,985 to $619,164—a reduction of $1,344,821. The company claims this cut is fair because of the shut-down of its smelter and the stopping of production, and heavy depreciation. It also claims its assessment was out of reason even in good times, its assessed valuation having been increased $1,100,000 in the two years of 1916 and 1917.

Nevada County.—Ray C. Rassen, Commissioner, appointed by the Superior Court of Nevada county, has authorized the sale of all the holdings of the Mountaineer Mines Consolidated, to satisfy a judgment obtained July 2 last by Peter Bender of Santa Clara county for over $151,000. The property involved consists of some 33 lots and patented quartz claims, rights of way, pipe-lines, and surface improvements. The property, which has had a varied existence as a producer, is close to town and adjoins the Champion holdings on the east and south.

Placerville.—Following examinations by E. A. Gabriel and W. E. Davis of Modesto, large owners, arrangements are being made to re-open the Landecker, formerly a producer of gold-quartz and gravel. Richard Reynolds is superintendent. John E. Patterson, Long Beach, has purchased the Blackburn gravel mine near Fairplay, which adjoins the Rocky Bar placer group on the middle fork of the Cosumnes river. Development of the channel is to start immediately.

Sloat.—Feather River Gold Mines Co. has concluded an excellent placer season and is preparing to improve the dam and develop new ground. Henry Halstead is in charge.

COLORADO

Cripple Creek.—Contractors are sinking a shaft on the Dexter for the leasing firm of Anderson & Benkelman. Lessees of the Gold Sovereign Mining & Tunnel Co. are mining ore from a vein four feet wide on the 9th level. A carload of ore from the Maggie mine of the Cresson Consolidated company brought settlement at the rate of $83.60 per ton. The ore was mined by Duchesne and Kearns.

Twenty-seven sets of sub-lessees operating under the Owen-Roberts lease on the Strong mine at Victor are producing a car per day. It is planned to sink the shaft of the South Burns mine from its present depth of 1450 ft. to 1700 feet.

Fairplay.—The Mudsill Gold & Silver Mines Co., with offices in Denver, has taken over the properties along the London fault fissure known as the Sherwood, Camp Bird, and Kurt, and now owns approximately 300 acres on this fault. The claims named have produced in excess of $100,000 from light development. John B. Stephens is president of the company.

Leadville.—An electric storm recently disabled the power-line and stopped the pumps at the Penrose mine. As the electric hoists were also stopped, the miners had to climb the ladders to escape. The Hibschle sub-lease of the Down Town Mines company is producing a good grade of lead carbonate and iron flux, with prospects for increased production in the near future.

IDAHO

Mullan.—The National Copper Mining Co. earned $25,000 net in June, compared to an earning of $20,000 for the month of May. The mine is opened for 1000 ft. in depth on the pitch of the vein, with an 800-ft. perpendicular shaft.

George Craddock of De Borgia is operating a group of 10 claims situated in the De Borgia copper belt on the same vein system as the Monitor, Richmond, and St. Lawrence mines. Two adits are being driven. Present development amounts to more than 2000 ft. of adits, drifts, and crosscuts, and there is a large tonnage of ore of a milling grade.

MINNESOTA

Cosby.—Capt. Gulgren and three miners were badly gassed last week by a fire in drift 48 of the Armour No. 2 mine.

MONTANA

Libby.—C. E. Lukens, president and manager of the Lukens-Hazel Mining Co. of Libby, Montana, will build a power-plant and concentrator on the property; it will be capable of milling 200 tons of ore per day and will cost about $200,000.

Rimini.—The Gould placer mines located four miles above Rimini on the Try Again branch of the Ten-Mile have been sold to Charles Hewett of Butte for a group of Salt Lake investors. Work has already been started on a hydraulic plant.

Saltese.—The working force at the Tarbox mine has been cut to 12 men. Only four men are working underground.

NEVADA

Carson City.—The Carson Free Gold property is reported to have cut four feet of high-grade ore.

Tonopah.—The wet jack-hammer drilling contest held here on July 4 resulted in the following prize-winners:

First—Dan Boyd, 56-10/16 inches.
Second—George Lynch, 52-2/16 inches.
Third—Adam Ogi, 49-14/16 inches.
Fourth—Ed. Yender, 48-8/16 inches.

OREGON

Medford.—We have received a letter from A. E. Kellogg, of Gold Hill, entering a friendly protest against the statement appearing in this column in our issue of July 12, that the War Eagle mine carried 3½ to 4% mercury over a width of 5½ ft. Mr. Kellogg further states that he has recently inspected this property, and that he is moved to protest in the interest of the district, which can only be injured by such extravagant reports. We are glad to make this correction here.—News Editor.

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

Henry Hanson left on July 12 for Idaho for a professional trip which will take several weeks.

Maurice D. Leehey was in San Francisco last week on his return from Washington to Seattle.

C. Legrand, consulting engineer to the Phelps Dodge Corporation, has gone from Douglas to New York.

Cecil A. Gorelangton, Captain in the Engineer Corps, U. S. Army, sails for Shanghai on July 29 on his way to North China.

A. W. Geiger, Captain in the Engineer Corps of the U. S. Army, has returned to San Francisco after a year's service at the front in France.

J. Volney Lewis will spend several weeks in professional work in the Las Animas district of New Mexico. His address will be Hillsboro.

Lionel Lindsay, at one time on the staff of the M. & S. P., voyaged recently by aeroplane from Paris to London, 220 miles, in 2 hours 6 minutes.

J. C. E. Baker of Great Falls, and **C. L. Tout** of Butte, have recently taken a working bond and lease on the Pilgrim group of mining claims near Bozeman.

Charles E. Prior, Captain U. S. Army, has returned from France and is proceeding to Pachuca, Mexico, as chief engineer to the Santa Gertrudis company.

R. C. Gemmell, general manager for the Utah Copper Co., will become assistant managing director of the allied Jackling companies on August 1. **Louis S. Cates,** at present general manager for the Ray Consolidated Copper Co., will become assistant general manager for the Utah Copper Co. **C. D. Moffat** has been appointed metallurgical engineer to the Jackling companies.

The San Francisco section of the A. I. M. E. will meet at the Engineers' Club on Tuesday next, the 22nd inst., in order to hear an address from Mr. Philip N. Moore on 'The Engineering Council and the proposed Federal Department of Public Works'. The dinner will be at 6:30 as usual; the meeting beginning at 7:45 p.m.

William Tovote was killed recently by Yaqui Indians in Chihuahua, Mexico, while in the employ of the American Smelting & Refining Co. He was born in 1872 at Linden, in Germany, and graduated from the Mining Academy of Freiberg in 1901. After a short stay in Serbia, he came to the United States in 1905, and became honorably known as a mining geologist, contributing several articles to this paper. For several years he lived at Tucson, Arizona, and latterly at Venice, California.

The United States Civil Service Commission announces that the examinations listed below will be held in San Francisco at an early date.

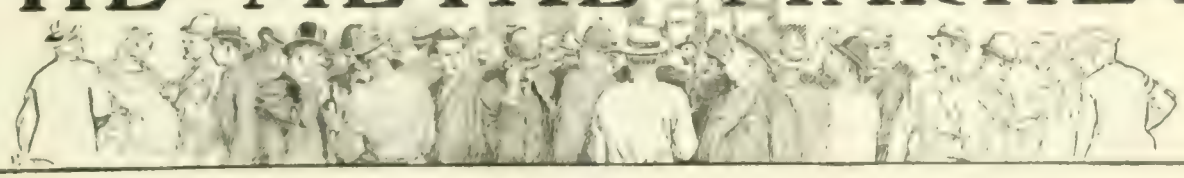
Assistant in tobacco investigations (male), $1200–$1800 per year; vacancies in the Bureau of Plant Industry, Department of Agriculture, for duty in the field.

Assistant instructor, Motor Transport Training School (male), $1500–2400 per year.

Stationary fireman (male), $1000 per year; vacancy in Quartermaster Service, Presidio of San Francisco.

Application blanks and further information relative to these examinations may be obtained from the secretary, Twelfth Civil Service District, room 241, Post-Office Bdg., San Francisco, California.

THE METAL MARKET



METAL PRICES

San Francisco, July 15

Aluminum, cast, cents per pound	50—60
Antimony, cents per pound	8.50
Copper, electrolytic, cents per pound	21.50
Lead, pig, cents per pound	6.75—6.85
Platinum, pure, per ounce	$105
Platinum, 10% iridium, per ounce	$115
Quicksilver, per flask of 75 lb.	$100
Spelter, cents per pound	9.50
Zinc, cast, cents per pound	10.00—12.50

EASTERN METAL MARKET

(By wire from New York)

July 15.—Copper is active and advancing. Lead is in better demand. Spelter is active and higher.

SILVER

Below are given official or ticker quotations, in cents per ounce of silver 999 fine. From April 23, 1918, the United States government paid $1 per ounce for all silver purchased by it, fixing a maximum of $1.01½ on August 15, 1918, and will continue to pay $1 until the quantity specified under the Act is purchased, probably extending over several years. On May 5, 1919, all restrictions on the metal were removed, resulting in fluctuations. During the restricted period, the British government fixed the maximum price five times, the last being on March 25, 1919, on account of the low rate of sterling exchange, but removed all restrictions on May 10. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the normal rate of exchange.

Date	New York cents	London pence	Average week ending	Cents	Pence
July 9	107.00	53.18	June 3	108.90	52.90
" 10	106.00	53.12	" 10	109.43	53.27
" 11	106.12	53.25	" 17	111.98	54.48
" 12	106.37	53.25	" 24	111.52	54.40
" 13 Sunday			July 1	108.83	53.48
" 14	106.12	53.62	" 8	107.52	53.47
" 15	106.50	53.87	" 15	106.35	53.38

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	75.14	88.72	101.12	July	78.92	99.62	....
Feb.	77.54	85.79	101.12	Aug.	85.40	100.31	....
Mch.	74.13	88.11	101.12	Sept.	100.73	101.12	....
Apr.	72.51	95.35	101.12	Oct.	87.38	101.12	....
May	74.61	99.50	107.23	Nov.	85.97	101.12	....
June	76.44	99.50	110.50	Dec.	85.97	101.12	....

It has been announced that the U. S. Treasury has waived the restrictions contained in the agreement between the United States and Great Britain for the purchase here of 200,000,000 oz. of silver, which is taken to mean that the price of this metal may now move to still greater heights. At first the agreement provided for a price of $1 per ounce, then it went to $1.01½, and only recently silver sold as high as $1.14.

There is slight change for the better in the China market, the rates having advanced both in Shanghai and Hongkong because of the movement in exports. As was expected, the movement of gold to China has not been of much consequence. There is no improvement in the Indian situation. The drain on the Treasury is still going on, and the Government is obliged to maintain coinage at the old rate. If this situation continues, the silver market will be very firm.

COPPER

Prices of electrolytic in New York, in cents per pound.

Date		Average week ending	
July 9	19.75	June 3	16.37
" 10	20.00	" 10	16.81
" 11	20.25	" 17	17.58
" 12	20.50	" 24	17.89
" 13 Sunday		July 1	18.37
" 14	20.50	" 8	18.53
" 15	20.75	" 15	20.29

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	29.53	23.50	20.43	July	29.67	26.00	....
Feb.	34.57	23.50	17.34	Aug.	27.42	26.00	....
Mch.	36.00	23.50	15.05	Sept.	25.11	26.00	....
Apr.	33.16	23.50	15.23	Oct.	23.50	26.00	....
May	31.69	23.50	15.91	Nov.	23.50	26.00	....
June	32.57	23.50	17.53	Dec.	23.50	26.00	....

Boston—Some copper sales for delivery over the year end have been made at 20½c. per pound. Fairly good business has been done for September delivery at 20½c. with nearer positions generally one-quarter cent per pound under that month.

LEAD

Lead is quoted in cents per pound, New York delivery.

Date		Average week ending	
July 9	5.40	June 3	5.22
" 10	5.40	" 10	5.20
" 11	5.40	" 17	5.38
" 12	5.40	" 24	5.36
" 13 Sunday		July 1	5.40
" 14	5.40	" 8	5.40
" 15	5.50	" 15	5.42

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	7.54	6.85	5.60	July	10.24	8.03	....
Feb.	9.10	7.07	5.13	Aug.	10.75	8.05	....
Mch.	10.07	7.26	5.24	Sept.	9.07	8.05	....
Apr.	9.38	6.99	5.05	Oct.	6.97	8.05	....
May	10.29	6.88	5.04	Nov.	6.38	8.05	....
June	11.74	7.59	5.32	Dec.	6.49	6.90	....

ZINC

Zinc is quoted as spelter standard Western brands, New York delivery, in cents per pound.

Date		Average week ending	
July 9	7.55	June 3	6.53
" 10	7.60	" 10	6.58
" 11	7.70	" 17	6.88
" 12	7.80	" 24	7.02
" 13 Sunday		July 1	7.36
" 14	7.90	" 8	7.45
" 15	7.90	" 15	7.74

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	9.75	7.78	7.44	July	8.98	8.72	....
Feb.	10.45	7.97	6.71	Aug.	8.58	8.87	....
Mch.	10.78	7.67	6.53	Sept.	8.33	9.58	....
Apr.	10.20	7.04	6.49	Oct.	8.32	9.11	....
May	9.41	7.92	6.43	Nov.	7.76	8.75	....
June	9.63	7.92	6.91	Dec.	7.84	8.49	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. Prices, in dollars per flask of 75 pounds:

Date		Date	
June 17	95.00	July 1	95.00
" 24	95.00	" 8	100.00
		" 15	100.00

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	81.00	128.06	103.75	July	102.00	120.00	....
Feb.	126.25	118.00	90.00	Aug.	115.00	120.00	....
Mch.	113.75	112.00	72.80	Sept.	112.00	120.00	....
Apr.	114.50	115.00	73.12	Oct.	102.00	120.00	....
May	104.00	110.00	84.80	Nov.	102.50	120.00	....
June	85.50	112.00	94.40	Dec.	117.42	115.00	....

TIN

Prices in New York, in cents per pound:

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	44.10	85.13	71.50	July	62.60	93.00	....
Feb.	51.47	85.00	72.44	Aug.	62.53	91.33	....
Mch.	54.27	85.00	72.50	Sept.	61.54	80.40	....
Apr.	55.63	88.53	72.50	Oct.	62.24	78.82	....
May	63.21	100.01	72.50	Nov.	74.18	73.67	....
June	61.93	91.00	71.83	Dec.	85.00	71.52	....

ENGLAND'S STOCKS OF METAL

Boston—On the first of the current month, the British government had on hand the following stocks of non-ferrous metals (in long tons): Copper, 44,298 tons; spelter, ordinary, 26,059, fine, 13,356; lead, 121,135; antimony, 4368; nickel, 2452; aluminum, 10,662.

In pounds this means that England on July 1 had on hand in surplus stocks 99,277,400 lb. of copper, compared with 107,502,080 lb. on June 1, a decline of about 8,250,000 lb. This is indicative of the fact that a considerable tonnage of copper is being melted at the present time. During June she imported a substantial tonnage of copper bars yet at the same time she was busy enough to eat into her surplus.

In lead, however, the story is different. Great Britain on the first of this month had on hand 271,342,000 lb. of lead, 3,000,000 lb. more than last month and compared with December 19, 1918, the date all restrictions on British metal were removed, an increase of over 160,000,000 pounds.

The nation's supply of zinc also expanded last month. On July 1, 88,289,600 lb. were held by the government, or about 2,300,000 lb. more than in June. There has not as yet appeared any substantial export buying in the American zinc market.

The following (in pounds) pictures present holdings of England compared with previous months, and also compared with stocks on December 19, 1918:

	July 1	June 1	May 1	Dec. 1918
Copper	99,227,520	107,502,080	114,531,200	61,667,200
Lead	271,342,400	268,591,680	244,186,880	110,008,640
Spelter	88,289,600	86,078,720	76,090,560	56,698,880
Aluminum	23,874,080	24,458,560	25,854,080	22,881,610
Nickel	5,492,480	7,956,480	5,750,080	.....
Antimony	9,784,320	10,080,000	9,992,640	.....

From the above it would appear that England may be as active a buyer of American copper in the not distant future as will the Teutonic countries when proper credit has been established for them. Certainly it begins to appear as though the world were not as glutted with metal as 90 days ago.

Eastern Metal Market

New York, July 9.

The holidays Friday and Saturday, July 4 and 5, caused a lull in the markets, but the tone this week is strong and demand is quickening.

Copper has continued to advance on heavier demand, both foreign and domestic.

The tin market has been quiet but steady.

Very little has been done in lead but the tone is strong and prices are firm.

Demand for zinc has decidedly improved and prices are advancing.

Antimony is unchanged.

IRON AND STEEL

There is no marked change in the situation, but when general conditions are summed up the conclusion is that the market is slowly forging ahead to better things. Many Northern makers of pig-iron are now comfortably booked with orders for third quarter delivery, some have sold well into the fourth, and a little business for 1920 delivery has been closed. Alabama furnaces expect to benefit from the sold-up condition of their Northern competitors. Southern prices for pig-iron are slightly stronger, although in Pennsylvania concessions are still being made. Inquiries are coming from England, Sweden, and Holland. In finished steel products, wire and wire products and tubular goods are most active, with structural material making a good showing in the central West. The steel industry in general is adhering to about two-thirds of capacity. Several makers of bolts and nuts have advanced their quotations, having put bolts up 5%, nuts, except semi-finished, up $3, and rivets up 10%. Export inquiry is more ecouraging, especially that coming from the East. Japan is in the market for both rails and plates in round tonnages. The Railroad Administration is showing no disposition to buy, a policy which is authoritatively said to be hurting the railroads more than the steel mills. Confidence in the stability of present prices is growing.

COPPER

Twenty cent copper is apparently nearer than was predicted a short time ago. July delivery of electrolytic copper is hard to get under 19.75c., New York, with some producers sold out for this position. Others are quoting as high as 20c. For August not less than 20c. can be done with probably 20.25c. a fair valuation. For July-August delivery 20c., New York, seems to be general today. We quote the market as 19.75 to 20c. for July delivery for electrolytic copper with Lake firm at 20 to 20.25c., New York. Inquiry is reported as very brisk with sales good both for domestic and foreign account, Japan being still a buyer. Consumers seem to be of the opinion that a rising market is at hand and are taking more interest. The market grows stronger daily.

TIN

An absolutely free market, except perhaps so far as the necessity for certain import licenses is concerned, seems assured now after September 1. An announcement of July 3, effective July 1, is to the effect that import restrictions have been removed as of September 1 on pig-iron and metal alloys containing tin when imported from countries other than countries of origin. It is expected that soon even import licenses to bring in tin will be no longer necessary. Because of the holidays on Friday and Saturday the market has been quiet; there has been very little demand. Straits tin from stocks is unchanged at 70.50c., New York. The London market has been strong the last few days and it has had its effect here so that Straits tin from England is quoted at 53c. per lb. with 52c. asked for this grade from the Far East. Lamb and Flagg tin for importation is held at 52c. American 99% metal is quoted at 67 to 68 cents.

LEAD

This market is very quite but firm. There has been a fair amount of inquiry but it has not resulted in any large amount of business despite reports that the demand has been big. Quotations are unchanged at 5.40c., New York, or 5.15c., St. Louis, these levels obtaining in both the outside market and as the bid of the leading interest. An unconfirmed report is to the effect that the American Smelting & Refining Co. has sold September-October delivery at 5.60c., New York.

ZINC

The inquiry for zinc has broadened and in the last two or three years the tone of the market has become considerably stronger. Prime Western for early July delivery is not quoted and sold at 7.15 to 7.20c., St. Louis, or 7.50 to 7.55c., New York, with not less than 7.20c., St. Louis, asked for August. The principal cause of the strength is said to be demand for export as well as a quickening demand on the part of domestic consumers.

ANTIMONY

No change is reported and prices are nominal at 8.37½ to 8.50c., New York, duty paid.

ALUMINUM

No. 1 virgin metal, 98 to 99% pure, is obtainable at 33c., New York, for wholesale lots for early delivery.

ORES

Manganese: There is a little more inquiry, but buyers and sellers cannot get together on price, which springs partly from the inability of the sellers to obtain cheap freight rates.

Manganese-Iron Alloys: Ferro-manganese is in light demand following the recent flurry of buying. Although American producers are quite generally quoting $125, delivered, it is believed that $115 and possibly $110 would not be refused in some directions. The British price is $115, seaboard. Spiegeleisen is unchanged at $30 to $35, furnace.

Molybdenum: The market is dull, with prices unchanged at 75 to 85c. per lb. of MoS_2 in 90% concentrate.

Tungsten: Despite the holiday considerable activity is reported, and there is additional inquiry for high-grade ore for home consumption which is expected to materialize soon. Chinese ore for spot and forward delivery has been sold around $7 per unit. Business has been done in tungsten ores for shipment to Europe—the first in a long time.

Wire manufacturers are the best buyers of copper, and their efforts to obtain it simultaneously have been quite in line with plans to advance the market. The agencies and producing interests not members of the Copper Export Association have been coming more in competition with that organization and have been underselling the larger factors in the export market. The demands of the Scandinavian countries, which have been a growing factor in the export buying, have been chiefly for wire rods. Much, if not all, of this copper will eventually find its way into Germany, producers believe.

AS our readers are aware, Mr. Frank H. Probert, Professor of Mining and Dean of the Mining College in the University of California, was one of a commission of three Americans sent early this year to investigate conditions in the devastated mining regions of northern France and southern Belgium. He had an opportunity to see the effects of German sabotage and to study the work of rehabilitation. In this issue we publish an interesting article on the subject, illustrated by some of his own beautiful photographs.

JUDGE BOURQUIN of the U. S. District Court of Montana on July 19 handed down his decree in the Minerals Separation v. Butte & Superior case in accordance with the recent judgment of the Supreme Court of the United States. The effect of this is to enjoin the mining company from further infringement of patent No. 835,120 and to impose payment for damages, yet to be determined by an accounting, for their trespass on the rights of Minerals Separation up to the end of 1916, after which time the mining company, by using more than 1% of oil per ton of ore, ceased to infringe.

STATISTICS of American copper production, as collected by Mr. B. S. Butler of the U. S. Geological Survey, will be found in this issue. It is interesting to note that the output during the last three years has been steady at a tremendous total, which is about 60% greater than the production before the War. Of this increase about 35% is estimated to be normal and 25% is due to the demands created by the War. Among the States of the Union the leading producer is Arizona, whose output of 769,500,000 pounds of copper reflects the splendid activities of the big mines of the disseminated chalcocite type, notably the Inspiration, Miami, Ray, and New Cornelia. The production of Arizona is more than double that made by any other State; it is about equal to the combined outputs of Michigan, Montana, and Utah.

IT looks as if the latest Mexican outrage would stir the Administration into action, at last. The insult to the American flag involved in the robbery of a crew that went fishing near Tampico in a boat from the U. S. S. 'Cheyenne' is one that cannot be passed, as many other acts of brigandage, have been. An inquiry into the murder of John W. Correll, an American citizen, in the same region, is likewise under way. Since then Peter Catron, another American, has been murdered in the City of Mexico. We note also that Theodore Patterson, the superintendent of the Mazapil Copper Company in Zacatecas, has been killed by other bandits while engaged in professional work. He was a Briton, and we trust that his government will stimulate the gentlemen at Washington to something more lively than 'watchful waiting'. Of that we have had enough and to spare.

WHEN a mining company reaches an age of 25 years and has produced gold steadily during the whole of its life, it is entitled to a celebration. We note that the twenty-fifth anniversary of the Great Boulder Proprietary Gold Mines was recorded at the recent annual meeting of the company in London. The mine has produced £11,649,970, or (taking the pound sterling at $4.70) $54,754,859 worth of gold, at a profit of £6,699,293, or $31,486,677, enabling a distribution of £5,531,800, or $25,999,460, in dividends; and the end of the life of this splendid property is not yet in sight, for over $5,000,000 worth of ore is still in reserve. Moreover, the company is on the look-out for fresh mines to be operated under its existing excellent management, of which Mr. Richard Hamilton is the chief. He has been resident manager, at Kalgoorlie, Western Australia, at least since 1897, when the present writer visited the mine and went underground with him.

OIL-SHALE is an interesting topic of discussion at this time, so we are particularly pleased to publish a letter from Mr. Arthur L. Pearse on this subject, with which he is familiar, having himself had practical experience in the production of oil from shale and from coal. The figures of cost he gives are most welcome; also those of yield. Most writers on this new branch of mining content themselves with airy generalities, thereby failing to attract the more sagacious type of business man. Mr. Pearse lays stress on the question of marketing the product; that, of course, is one point on which the financial world or the investing public, meaning those who find the capital for mining enterprise, is sceptical. So long as liquid petroleum can be drawn from wells and pumped through lines of pipe for long distances, the shale-oil will be at a disadvantage unless the mine is close to a railroad. However, the consumption of well-oil is so great and the sources of it so limited that the day must come soon when a market will be available for rock-oil. The increasing price of oil favors this expecta-

tion. We note that Mr. Carl H. Beal, in Bulletin 177 of the U. S. Bureau of Mines, states that "the limit of oil production is being approached and that, although new oilfields undoubtedly await discovery, the yearly output must inevitably decline, because the maintenance of a given output each year necessitates the drilling of an increasing number of wells." Another factor is the draining of virgin ground by neighboring wells, thereby diminishing the anticipated yield of undeveloped areas adjoining them. While we deprecate undue optimism, especially such as lends itself to irresponsible stock-jobbing schemes, we believe that the profession can well afford to pay attention to the possibilities of shale-oil production, so as to be ready to guide the public when the occasion arises.

HUMOR is often unconscious. We find much to amuse us in the circulars and prospectuses of persons offering for sale either mines or machinery without knowing much about either. A little pamphlet describing a dry concentrator has been sent to us; we forbear mentioning the name because we believe the inventor and seller is acting and writing in good faith; but we think it fair to expose some of his blunders, because any man in his position ought to take pains to be better informed. In the pamphlet we are told that "the State of Arizona has more than 125,000 square miles. Much of this is wild waste land—and everywhere one may find black sand—which is only oxidized gold, that is, gold that has united with the oxygen of the air, defying all former processes," except, of course, the one now offered to the simple-minded miner among the cactus and prickly pear. We think it unnecessary to italicize the obvious blunder. Again, "there are many placer deposits containing unlimited quantities of free gold, but without water; nobody has ever been able to save these values." Well, there is "unlimited" water and "unlimited" gold in the sea and "nobody has ever been able to save" the more valuable of the two, in sufficient quantity, although many attempts have been made. However, we do not mind Mr. Dry Concentrator's nonsense about the resources of Arizona so much as his statement concerning the cost of operation. He gives an itemized estimate in which he puts down a superintendent at $5 per day, a cook at $3, a teamster at $3, a furnace man at $3, and eight laborers at $2. Surely this is a bad anachronism, one cannot employ such men for such wages in Arizona at this time, unless it be Navajos or Papagos. By such figuring he gets a cost of 50 cents per ton, when it is dollars to doughnuts that the cost would be more than twice as much. As against the 50-cent cost, he expects a $5 yield of gold. Of such flimsy fabric are dreams made. We hope the gold will not be oxidized.

DEPRESSION is the dominant note of a forecast made at Johannesburg by Mr. C. D. Leslie, consulting engineer to the Consolidated Gold Fields of South Africa, in his recent valedictory speech to the Institute of Engineers of South Africa. The impending cessation of operations at a large number of low grade mines in the near-eastern portion of the Rand goldfield moved him to sundry sad predictions. Fourteen mines, extending from the New Goch to the East Rand Proprietary, earned an average profit of only 14 cents per ton during the preceding quarter, and it must be remembered that only 70% of the so-called profit of these companies is translatable into dividends. The flow of water underground, says Mr. Leslie, is at the rate of 3000 million gallons per annum and costs about 50 cents per thousand gallons to pump. Should the increasing cost and decreasing yield of this group of mines compel a closing-down, the water would overflow into the neighboring properties and would penetrate the workings of the Central Rand, unless special efforts were made to arrest the inundation. Mr. Leslie is of the opinion that it would never pay to re-open the poor mines, in view of the water difficulty, the caving of the workings, and the decay of the plant. Not only has the pay of the white workers increased rapidly since 1914, but their efficiency has undergone a marked decline, and also that of the natives employed on the Rand. The cost of labor has increased $1.25 per ton during the past five years. The outlook is anything but cheerful.

The Flotation Process and Its Makers

Last week's issue contained a letter from the firm of Sulman & Picard; this week we publish a short note of later date, in which these distinguished metallurgists ask us to draw attention to the "enormous benefit" conferred upon the mining industry by the Minerals Separation company, with which they are so prominently identified. Our editorial last week on the origin of the froth-agitation process dealt with one phase of the subject; for the rest, we are quite willing to recognize the services of Messrs. Sulman and Picard, and of the numerous other technicians employed by Minerals Separation Limited, in developing the flotation process, but to us it seems only a part of the big work done during the past fifteen or twenty years in applying the modifying influence of oil to the water used in concentrating the valuable constituents of ores. We would be quicker to express a generous estimate of the efforts made by Messrs. Sulman and Picard and their friends if we were not so hampered by the memory of facts. Unfortunately for the easy winning of a reputation for "impartiality," to which reference was made in the letter published last week, we recall the fact that the Minerals Separation's basic patent No. 835,120 was obtained in 1905, yet their own first successful application of their method was not made until eight years later, at the Inspiration mine in 1913. Speaking from the American standpoint and from the point of view of their American patent of 1905, it appears that they did not introduce their process to the American mining industry until eight years after the grant of the patent. Moreover, in an official report dated January 8, 1911, by Mr. J. M. Hyde, then on their staff, the statement was made that the tests performed in the Minerals Separation laboratory proved that "the copper

ores of a good part of the South West and also of at least a portion of the Utah region contain chalcocite, which is not floatable by any of the methods so far tested." This referred to the big deposits of disseminated chalcocite to which flotation has been so successfully applied, by others, since then; the statement as made by Mr. Hyde, who severed his connection with the patent-exploiting company shortly afterward, summarizes the opinion of the Minerals Separation staff at that time. Mr. T. J. Hoover, who was their general manager and technical advisor, resigned in December 1910 and published his book on 'Concentrating Ores by Flotation' in 1912. In that book, which was carefully revised by Messrs. W. H. Ballantyne and S. Gregory of the Minerals Separation company and to the publication of which they gave a grudging consent, it is stated, "An ore in which the valuable minerals are wholly or partly bornite or chalcocite, as those of Bingham canyon, will probably give trouble to flotation processes, although not always, for among the many ores tested the one which gave the most uniformly satisfactory results was a copper ore assaying 2.8% copper, all in the form of microscopic specks of bornite." So he remarks: "It may be that only those where bornite and chalcocite are of secondary occurrence give trouble." The reference is to the ore of the Utah Copper Company, which has developed the application of flotation on an enormous scale. The mention of secondary enrichment, of course, would except all the great 'porphyry' mines of the disseminated type in Arizona, New Mexico, and Nevada, to which others have applied flotation so successfully. The evidence shows that their lack of knowledge concerning their own process, and their positive assertions concerning its metallurgic limitations, delayed the successful use of the process in this country, in which they had secured a patent, for eight years. It is true, Messrs. E. H. Nutter and G. A. Chapman, of Minerals Separation, made successful experiments, leading to the erection of a mill, at the Inspiration mine in March 1913, but in the same month Mr. T. A. Janney likewise made his first successful experiment on low-grade chalcocite ore at the Utah Copper Company's mill. Moreover, the success of the Inspiration mill was due, and is still due, largely to the use of the pneumatic froth-making machine devised by Mr. J. M. Callow. The effective application of froth-flotation to low-grade copper ores in the United States did not become a fact until 1915, that is, ten years after the date of the Minerals Separation company's basic patent. So we venture to submit to our readers that we are not ungenerous in refusing to give the entire credit for this valuable metallurgical process to the Minerals Separation people, because neither in its discovery, as pointed out last week, nor in its application, as above outlined, were Messrs. Sulman, Picard, and Ballot the only persons concerned. They have done a notable service by their persistent efforts, ever since 1901, to develop an effective process, just as the Elmore brothers for six years before them kept the idea of the use of oil as an agent of concentration before the public, but the flotation process as used on American mills today is the product of research and experiment by a host of metallurgists and mill-men, at the head of whom we would be willing to place Henry Livingstone Sulman and Hugh F. K. Picard, but with them and sharing honor with them we would name Francis J. Elmore, Charles V. Potter, Guillaume D. Delprat, Alcide Froment, A. R. Cattermole, T. J. Hoover, J. M. Callow, J. M. Hyde, E. H. Nutter, G. A. Chapman, and Leslie Bradford, and a score of clever mill-men whose contribution to the art has been the development of the correct manipulation without which the scientific ideas of the others would have fared badly. The flotation process is not the brain-child of any one or two men; it is the composite product of the logical thought and the intelligent empiricism of at least a score of earnest workers. That is why we have fought the attempt of Messrs. Sulman, Picard, and Ballot to obtain a monopoly of the process and a monopoly of credit for the success of the process in the United States; and our opposition has been intensified on account of the high-handed methods adopted by them to bully the profession of which Messrs. Sulman and Picard are distinguished members, and, last but not least, on account of their ineffectual efforts to prevent the publication of information concerning the technology of the process.

Concerning Patents

Patents are intended to encourage and reward inventors by granting them sole rights to make, use, or sell their invention. Owing to the vast multiplication of mechanical devices and the enormous expansion of mechanical methods for performing industrial operations, the Patent Office has become of greatly increasing importance both to inventors and to the community at large. It has proved defective both in its procedure and in its performance, owing to the inadequacy of the staff and the resulting unsatisfactory examination of applications for patent. Moreover the promiscuous granting of patents upon conflicting inventions and the consequent resort to an unsatisfactory kind of litigation have decreased the value of ownership in a patent and made it difficult for inventors of small means either to enforce their rights or to sell them to advantage. The National Research Council, one of the useful creations of the war period, appointed a committee to investigate the subject and to make recommendations. This committee will command confidence, for it consists of Messrs. William F. Durand, Leo H. Backeland, M. I. Pupin, R. A. Millikan, S. W. Stratton, Reid Hunt, Frederick P. Fish, Thomas Ewing, and Edwin J. Prindle. Of these the first is chairman of the committee, he and the two next in order are scientists and inventors; the next two are scientists, the sixth is a physician, and the last three are patent lawyers. This is a group of men admirably fitted to study the subject and to suggest the changes necessary in the existing law. They have made four principal suggestions. The first is that there shall be a single Court of Patent Appeals, which shall sit at Washington, and the head of it is to be

a Chief Justice appointed for life by the President; the other judges are to be selected by the Chief Justice of the U. S. Supreme Court from the various District and Circuit judges in the country and each is to sit in the Court of Patent Appeals for six years, or longer if re-appointed. Next, the committee proposes to make the Patent Office a separate institution independent of the Department of the Interior, under which at present it receives no proper attention or direction, simply because the Secretary of the Interior is swamped by the multifarious duties arising from the numerous bureaus in his charge, nor is he a man selected on account of possessing any of the special qualifications needed for the proper supervision of the Patent Office. Thirdly, the committee recommends a large increase in the number of patent examiners and an increase in their salaries, so that men of the requisite ability may be employed. Finally, the committee advocates an amendment of the law whereby proper compensation for infringement of his patent may be granted to the patentee. It is believed, by the committee, that "the comparative certainty of financial return would answer one of the most common and strongest reproaches against the patent system, namely, that a patent does not ordinarily pay the inventor any money, and it believes that the incentive to invent would accordingly be greatly increased." Yes, it would; and we sympathize with the committee's well-intended proposal for this purpose, but it seems to us conditioned upon the adjudication of questions of infringement by a court qualified to pass judgment by reason of a competent understanding of the technology involved in a dispute over patent rights. The personnel of the proposed Court of Patent Appeals fails to give adequate assurance of a consummation so devoutly to be wished. It is thought, apparently, that by selecting from among the judges such men as have shown aptitude for the understanding of patent problems, it will be possible to form an efficient court for this special purpose, but that, it seems to us, would simply perpetuate the evil of submitting highly technical questions to the adjudication of men without sufficient training in the sciences applied to such questions. In course of time the members of the Court of Patent Appeals, if constituted as recommended by the committee, would become well informed at the expense of the litigants, but why not make a clean break from an unhappy precedent and organize a court composed of men with the exact qualifications required for the duty, namely, patent lawyers. Moreover, steps should be taken to keep disputes over patents out of the courts as far as possible. The business-man of today has learned that a lawsuit is a gamble, he prefers to keep out of the courts, he is afraid of verbal technicalities on the one hand and of the judicial custom of falling back on precedents, however defective in their origin. So he submits his case to an arbitrator. By doing so he does not expect to save the fee due to an advisor, or even the expense of legal counsel, but he is able to submit his case to a man of sagacity unhampered by the apparatus of the courts. An official arbitrator or intermediary is needed for the purpose of settling disputes over patents before they go so far as to require the intervention of a costly and uncertain litigation. Canada gives us a useful suggestion; there they do these things better in several respects. They have a Commissioner of Patents, who is empowered to abate the impetuosity of patentees and yet to protect them in their lawful rights. A patented invention must be manufactured within two years after the grant of the patent, so as to stop any dog-in-the-manger tricks. Furthermore, no invention can be imported "after the expiration of twelve months from the grant of a patent or an authorized extension of such period," except under special license. This is to compel domestic manufacture of the machine, but the Commissioner appears authorized to modify the regulation so that it may be reasonable in its incidence. Moreover, any person may apply to the Commissioner for a license to make, use, or sell the patented invention, in the event of the patentee refusing "to grant licenses to others on reasonable terms." In short, he is in a position to exercise discipline and to prevent a too exacting monopoly. In the United States the owner of a patent can decline to give a license to anybody at will or can levy a royalty as large as he pleases; he can charge one person a royalty of 10 cents and he can mulct another for 10 dollars; he need answer to nobody, unless, of course, he does something to bring him under the censorious eyes of the Federal Trade Commission, as has happened to Minerals Separation recently. It seems to us that it would be well if there were an officer of the Government, such as a Commissioner of Patents, empowered to hear patent disputes and to settle controversial points before going to a Court of Appeals. The Commissioner, even if occasionally he did not settle the dispute, would elucidate the salient technical facts and leave only questions of law for the Court of Appeals. We are reminded of the settlement of mining disputes by the Wardens in the Australian mining districts. Each district or group of districts has an official called the Warden, before whom come disputes over the boundaries of claims, trespasses underground, and other conflicts arising in the course of mining operations. It is a remarkable fact that mining lawsuits are rare in Australia for the simple reason that the decisions of the Wardens are usually so fair that it becomes unprofitable to carry the dispute into the courts. A Commissioner of Patents, with competent deputies, in order to deal promptly with any number of disputes as they arise, would be a boon and a blessing to a quarrelsome phase of human activity. In closing, we may state that we are not adverse to the grant of patent rights to inventors or to the reward to be derived therefrom by the pioneers of industrial progress; not at all. Some of our readers have interpreted our opposition to the Minerals Separation people as a desire to deny the rights of royalty to all inventors. That is not so. We have opposed them for reasons stated on another page in this issue and in the one preceding. We respect the genuine inventor and are glad to see him rewarded by being accorded special rights under the Government.

The Oil-Shale Industry

The Editor:

Sir—In your issue of May 24 you publish another interesting article by Mr. Hoskin. He speaks of the difference between American and Scotch shales, but there is just as much difference and a much greater variety of shale in this country; so much so in fact that it will be found necessary to adopt different methods of treatment. These differences are not only those shown by analyses but in the physical make-up; they require different methods of handling and no standard retort is adapted to every case. This is perhaps one of the reasons why more than 20 various kinds of retorts have been tried in this country, and still more are indicated.

Mr. Hoskin suggests a new name for oil-shale, but is this wise in view of the great line of division between shale that is represented by the Colorado-Utah deposits and the carbonaceous shales, both of which are bituminous?

He suggests that profits can be measurably augmented by making ammonium sulphate and crude potash. Saving some of the ammonia has for a long time been an integral part of the business, but as the extraction of good oil and ammonia is principally dominated by widely diverging temperatures, one or the other has to be sacrificed; to obtain best results in oil, lower temperatures are indicated, whereas for ammonia a higher temperature is demanded; in other words, low temperatures, 900°F. downward for oil and for ammonia up to 2000°F. This at once involves the question not only of the retort but the material of which it is constructed; consequently the cost and capacity of the retort. Certain moderate percentages of ammonia, of course, are recovered at low temperatures whether by wet or dry methods; the average recovery under present conditions is not 50% of the theoretical. As the Scotch shales are poorer in volatile but richer in nitrogen than the Colorado shales, more attention has been paid to the ammonia than is likely to be the case with the American shales of an average content of 0.55% or less. Regarding the potash, it is extremely doubtful if the cost and trouble involved are worth while; it was tempting when potash was worth $300 per ton, or more, as a war product, but not under normal market conditions.

Mr. Hoskin says that the manufacture of shale-oil is "not a formidable process nor does it involve an expensive plant," and then he states what a plant comprises. The fact is that the recovery of oil-shale is a difficult art and if properly carried out involves more than he would lead us to infer. It took the Scotchmen many years to make a success, and if "we should not base any plans for commercializing American oil-shales upon practices and successes in Scotland and elsewhere," are we to begin all over again or follow their lead?

Now as to expense: careful estimates for a complete 1500-ton Scotch type of plant, to be erected on this side, were a trifle over $1500 per ton-day; at the present time this would cost 30% more, or, say, $2000 per ton. Recently a 1000-ton plant for Colorado was figured at $1200 per ton. Both were of the continuous vertical type, with regulation methods for oil distillation and ammonia recovery; more modern types, both in the retort end as well as the stilling end, can be erected for $800 to $1000 per ton for plants of 1000 tons capacity upward, if on a railroad and under normal conditions. A pre-war cost of refining including recovering the ammonium sulphate was 62c. per ton with sulphuric acid at $6 per ton, while the retorting cost 40c. Today this cost is $1.25 and 70c., respectively; add to these the cost of mining or getting the shale plus general charges and you have a basal figure it should cost to recover the prime products.

It is a fallacy to suppose that high percentages of recovery are most economical. It costs too much and the last oil is the poorest. I have heard it stated that the Colorado-Utah shales will run 55 gal. per ton, with 0.55 nitrogen; if you get 42 gal., or a barrel, the prime products should be 16 lb. of ammonium sulphate; 15 lb. of wax; 33 to 36 gal. of gasoline and lubricating oil, with a residue of uncertain value. Much lower-grade shale will be worked, and will depend on the amount of uncondensed gas obtained. Most modern retorts require only two-thirds the heat we used in the older forms of retorts, and so will treat lower-grade shale. Generally, the poorer the shale the easier it is to run, besides which the nitrogen does not necessarily fall with the volatile contents. Sometimes the reverse is the case.

Steam-shovel methods of mining shale have been condemned, because the poorer grades become unavoidably mixed with the better grade, but the ability to retort lower-grade stuff favors shoveling with its saving in cost of mining by 75c. to $1 per ton.

Modern methods of coal carbonization help us much in the matter of retorts and retorting, and with the low temperatures indicated because of the low nitrogen contents of the shales referred to, the matter of retort construction is simplified; but merely condensing the gases in "air-cooled condensing-pipes" has given way to up-

to-date fractional condensation. A modern plant entails considerable capital expenditure and careful regulation, but it means lower running costs both in retorting and distillation with more satisfactory commercial results. To make a success you must carry the process further than merely separating the liquid from the non-condensible gases, and the recovery of ammonia. By fractional condensation the fractions can be obtained in one operation, and herein lies the profit.

Speaking of retorts, your contributor mentions a process in which gases of combustion are drawn upward through the charge. This method of heating was tried and patented years ago by certainly one of the most eminent men in the business, who personally told me it was abandoned because of the deleterious effects on the products evolved; this is easily proved by comparing the value of the oil produced by this method and that produced by ordinary methods of distillation. So it would seem that so far we are confined to distillation in air-tight retorts into which heated steam may be injected.

So many types of retorts have lately been designed that it is not possible to deal with them individually, but I am able to state that most any process involving mass carbonization is likely to fall out of competition. Indeed it is obsolete, except when the form and structure of the carbonized residue are of first importance, as in metallurgical coke, for instance. By 'mass carbonization' is understood the heating of a body of material, the particles of which are in close contact with each other, in contra-distinction to a condition in which each particle is unconfined. Mass carbonization involves the passage of the heat-units from the shell of the retort into the centre of the charge; it sets up the best heat-screen as carbonization proceeds. This is why the consumption of heat is so great in coke-ovens and the many forms of vertical retorts, both in shale and coal practice. The need for 2,000,000 or 2,500,000 B.T.U. per ton is common and is required because of the difficulty of causing the heat to penetrate the carbonizing material, which is always a good non-conductor. A good illustration of this is in a modern by-product coke-oven in which the diameter of the charge is, say, 14 inches; with a chamber temperature of 2000°F., it takes four hours to boil water in the centre of the charge. If small particles of shale or coal can be separately attacked by heat, not only is carbonization rapid but the gases evolve freely and need not be subjected to cracking or degradation, as is usually the case, and it can be effected by one-third less heat. By way of illustration, a half-inch cube of shale in a temperature of 750°F. requires five hours and a half to give off all its volatile, a quarter-inch cube requires three hours and twenty-five minutes, while in a temperature of 900°F. the time would be reduced to three and a half and one hour and a half, respectively.

Mr. Hoskin very wisely says there are many angles to the industry and only a few points can be discussed at a time. It is generally conceded that the industry has come to stay; the main question now is as to the best marketability of the product, or in other words, the question of distribution, which is applicable not only to the shale-oil, but to mineral-oil generally.

The destructive distillation or carbonization of coal in many of its forms in some countries has created quite as much interest as the treatment of shale. The questions involved are much more difficult, but what is being done today in England, and, I am informed, what we shall hear from Germany, will doubtless be an education, and I am sure it will be very helpful to the shale industry. If the treatment of oil is not a formidable process, we have the satisfaction of knowing that far more difficult problems are being and will be successfully solved, and I am right in saying that the commercial treatment even of intumaceous bituminous coal for oil has been successfully accomplished, and with due regard to the residue in the form of good metallurgical coke, which was certainly the most difficult problem of all. This question of the destructive distillation of shale or coal does not rest with them alone, but other forms of hydrocarbon, including wood, especially refuse, of which there are large quantities as sawmill waste, and which, instead of being a dangerous nuisance, can be turned into valuable products and power. Then the large quantities of lignite and peat, which are common, especially on the Western and Pacific slopes, will also come under consideration. Cheap power is necessary and will be in greater demand in the future; the road to it lies through by-product and producer gas, be it from shale, coal, or any other form of hydrocarbon.

I hope to hear more from Mr. Hoskin, for the future possibilities of the industry are great; it is being watched by people who have prevision, and although some say the time is not yet because of the present output of well-oil, it will soon be recognized as necessary and almost as easy to distill shale as oil, and quite as profitable; the risk is less, and the cost of obtaining the products from a barrel of oil-shale is no more than the average cost of a barrel of well-oil products.

ARTHUR L. PEARSE.

Engineers' Club, New York, June 25.

Minerals Separation

The Editor:

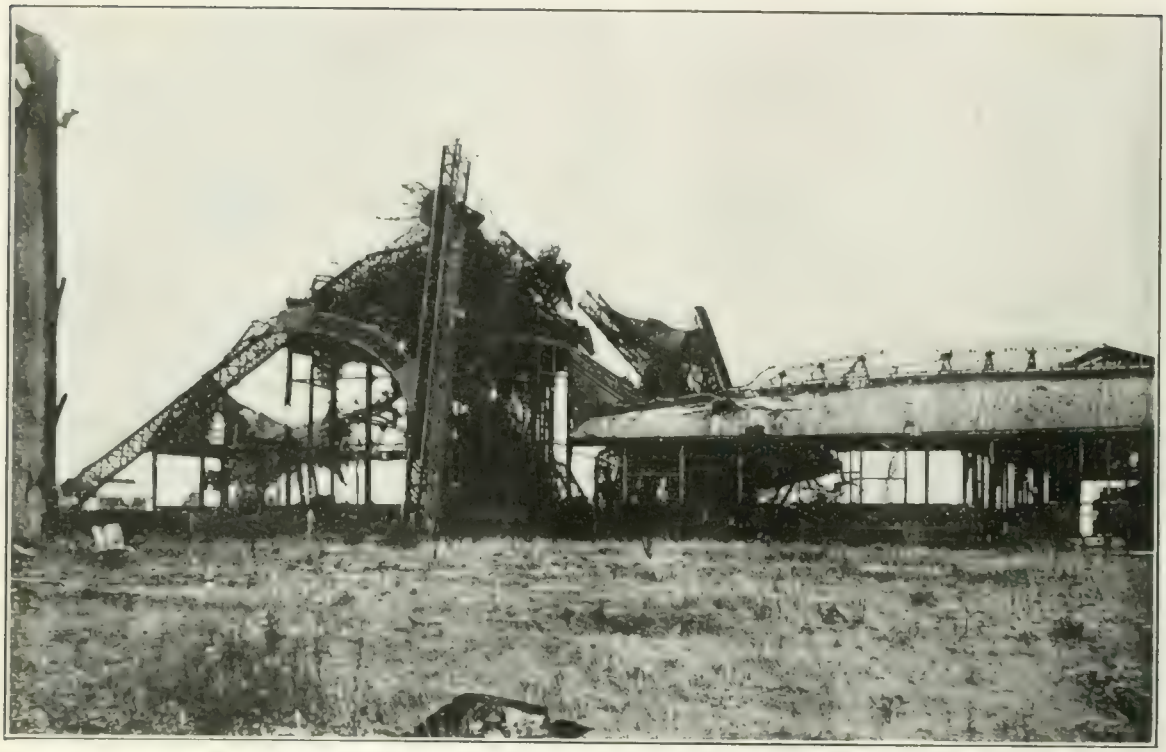
Sir—We have read your editorial note in your issue of the 7th June, calling attention to the Supreme Court's decision in the Butte and Superior-Minerals Separation case, which you describe as a severe blow to the mining industry. May we suggest that you also call the attention of your readers to the other side of the case, that is the enormous benefit the mining industry of the United States has derived from the froth-flotation process as patented by Minerals Separation, even though those who profit by it may be called upon to pay a small royalty to the patentees, whose rights have been at last established by the Supreme Court?

SULMAN & PICARD.

London, June 25.

LENS, IN APRIL 1919

SHAFT NO. 4 AT COURRIERE, IN THE PAS DE CALAIS



Shaft No. 11, at Bethune

Surface Plant at the No. 4 Shaft, at Courriere

Steel Plant at Longwy

Rolling-Mill of the Longwy Steel-Plant

Steel Works at Mont St. Martin

Shaft and Plant at Bethune

Ruin and Restitution in France

By FRANK H. PROBERT

It is almost five years to a day since the fostered dreams of world domination by Germany assumed tangible expression by challenging the balance of power. The dream is dissipated, right has conquered might, but at what a cost! During the seemingly endless days of struggle the Allies looked to the United States for moral, financial, and material support, and finally for the man-power that gave strength to the knock-out blow. The peace treaty was signed after much discussion, deliberation, and delay, in the same room at Versailles as witnessed the preliminary parleys for the exacting treaty imposed by Germany on the French, concerning the price to be paid for the Franco-Prussian war, but has the world caught the reflection from the Hall of Mirrors of the ruins of northern France, or the image of crimes unthinkable? This is not the time to arouse or excite hatred of the Hun, but, 'lest we forget' that the wounds of France still gape and that crippled industry will have to struggle for many years, a few close-up views are worth contemplating.

In 1918 M. de Billy,* as head of the French High Commission visiting Washington, invited Secretary Lane of the Interior Department to send a commission to France to study the condition of the coal and iron mines and discuss with French engineers plans for the future. At that time many properties had been destroyed by shell-fire—a destruction inevitable in waging such a war—but since June 1918 ruin of another kind has been wrought and wrongs done that cannot be excused, explained, or exculpated. In January of this year I visited the Western Front as a member of the American Mining Mission, my associates being Dr. F. G. Cottrell, and Mr. George S. Rice, of the U. S. Bureau of Mines. Every facility and courtesy was extended to us by both the French and United States governments to carry out the investigation, and in three months we motored nearly 2000 miles through the Pas de Calais and Nord districts of the Valenciennes coal-fields, the iron-ore districts of Luxemburg, Lorraine, and Lorraine Annexée, and the coal areas of the Saar Valley. My remarks are not based on hearsay information; my convictions come from close personal contact with the conditions as they exist today, and the accompanying views were portrayed by my camera. Documentary evidence is available to show that it was the intention of Germany to destroy the mines of France and so render her commercially impotent; field evidence shows that their plans were executed systematically, scientifically, and almost successfully.

In order to understand the German strategy of the Western Front it is necessary to look back fifty years. At that time Germany had great coal mines in Westphalia and the Saar province, and but limited iron ore resources. The possibilities of eastern Lorraine were being proved and by the Treaty of Frankfurt, signed on May 10, 1871, France ceded to her conquerors all the outcrop mines of the vast iron-field. The boundary was drawn with meticulous care, guided by engineers and geologists, to include all the land known to be commercially mineralized, but when Thomas and Gilchrist, two English metallurgists, developed the basic Bessemer process to treat high phosphorus ores, the French explored the lands to the west of Lorraine Annexée, with the result that in 1913 the known reserves of the great Briey basin were owned by the Germans and French in the ratio of 2,330,000,000 to nearly 3,000,000,000 tons respectively.

Immediately following the close of the Franco-Prussian war the Germans developed their steel industry with great rapidity, and just before the outbreak of the recent war they produced 21 million tons of iron ore from Lorraine Annexée and purchased 9 million tons from French Lorraine, from which they made 19 million tons of pig-iron annually. Of the iron ore smelted in German furnaces 58% came from Lorraine Annexée, and with the return of this land to France, the domestic supply will be less than 20% of the capacity of the plants. France received German coke in return for iron ore. In normal times France is compelled to import coal to meet her domestic and industrial needs. In 1913, 43 million tons of coal was mined from the Valenciennes field and 20 million tons imported. Here then was the situation; an iron ore supply coveted by Germany coextensive with Lorraine Annexée, and practically all the coal mines lying immediately south of the Belgian border. The German hordes swept down into France and for over four years the titanic struggle was fought out on the fringe of the mineralized area. Two-thirds of the iron reserves were in the hands of the Enemy during the War. It was in order to strengthen the hold on this important asset that the St. Mihiel salient was formed and Verdun attacked in 1916, while the bitterest of battles were ceaselessly waged for possession of Lens, the centre of the coal-field. Both iron and coal mines were worked by the Germans during their occupancy, worked as intensively as their diminishing virile man-power would permit; captive labor was forced to assist, and compelled under threat of death to participate in the wilful destruction, as soon as the inevitable result of the war was realized. The steel works of Lorraine, metallurgical

*We regret deeply to record the fact that Colonel Edouard de Billy was thrown from his horse and killed on June 12 in France.—Editor.

plants planned and equipped with every modern device for efficient operation, were quickly modified to turn out weapons of war during the first year of the conflict, after which, as I shall show, they were dismantled piecemeal; the desirable equipment being transported across the Rhine, the rest destroyed with a deviltry difficult to comprehend. At the south end of the district the steel plants at Pont-a-Mousson were damaged by shell-fire: this town was never occupied by the Germans, but from Briey northward to the Luxemburg line, the wonderful works have been sacked and wrecked beyond recognition. Coal and iron are complementary minerals, the two *grand seigneurs* of the mineral world. From them are fabricated the weapons of war as also the plowshare of peace; with them a nation is strong financially, commercially, and industrially, always, of course, assuming the legitimacy of motive prompting production. Bismarck characterized the former war as one of "blood and iron," the iron of Lorraine was the price of peace, and the industrial association of Berlin and Dusseldorf in 1917 declared to Hertling and Hindenburg that "the annexation of the Briey and Longwy basin is indispensable because the possession of this region is of incalculable value to Germany for economic, industrial, and agricultural reasons, in view of a future war."

In 1913 the 29 iron mines of the invaded section of the Briey and Longwy basins gave employment to 15,200 men and produced 17½ million tons of ore. During the four years following August 1914 the Germans worked the mines intermittently, they shipped all of the ore on the stock-piles to the steel works, and mined at the rate of 30% normal output. The underground workings were not seriously damaged at any of the properties, although many of the surface plants, particularly the miners' dwellings, were razed. The damage is more indirect and the visiting engineer notes that the ore was removed from the most convenient workings; pillars have been robbed near the main galleries, thus threatening the arteries of underground transportation; the extraction of ore without proportionate advance of development headings will postpone the pre-war scale of output for some time; the machinery has been abused for want of lubricants and every ounce of copper, the trolley-wires, motors, brass fittings, as well as all rubber, have been removed. The truth of the story that thunderous applause followed the statement of the Chancellor in the Reichstag denying the shortage of copper was drowned by the noise of the tinsmiths removing the copper sheeting from the roof of the buildings, is emphasized wherever one goes in the invaded territory.

Unquestionably large sections of the developed areas underground will be permanently abandoned because of the improper mining done by the robbers. At St. Pierremont I was impressed by the extraordinary regard for the welfare of the workmen; hundreds of cases of mineral water were stored at the shaft-station on one of the levels for the Germans to drink, fearing the valiant had copied the vicious and contaminated the water supply!

Iron ore is of no value unless it can be beneficiated. What has happened to the steel plants? Visit Micheville, go to Longwy, ponder the ruins at Mont St. Martin; never a shell was fired here, but the destruction is complete. At the first mentioned plant M. Nahan, the veteran manager, bowed with the weight of years and tormented by the nightmare of recent events, tells of the conscription of 2000 of his Italian workmen to destroy the model plant. German officers dwelt in his house while he was kept prisoner, presentation bronzes were confiscated for the few pounds of copper they contained, and the plant itself, what of it? all machines that could be moved were shipped to the Fatherland, the rest destroyed; it is a mass of fallen stone and twisted steel, a scrap-heap impossible to describe. At the Aciéries de Longwy, the largest steel works in France and employing 7000 men before the War, the ground must be cleared clean that a new mill may memorialize the irrepressible spirit of France. Here one sees train-loads of high-grade steel cut up into movable pieces that were to have been sent to Hunland to be turned into shells; the crank-shafts, rollers from the mills, and cylinder-heads were cut with the oxy-acetylene torch or broken by liquid-air cartridges (high nitro-glycerine explosives were getting short toward the end), the boilers were blasted, and the structural steel of the buildings cut at the base, to be overturned. M. Dreux, the managing director of the company, showed me two antique brass candle-sticks on the mantel of his living-room labeled by the marauders and spared to posterity because they were considered 'works of art'. Surely such magnanimity entitled Germany to mercy at the peace-table!

The Pas de Calais and Nord coal mines have suffered even more than the iron and steel plants. The damaged area embraces 24 of the 27 concessions; the Bruay mines were not forced to shut-down although damaged by long-range shell-fire and aerial bombs; eight concessions suffered from artillery bombardment and were later pillaged, while toward the eastern end of the district sabotage finds its most glaring expression. Twelve concessions had the surface plants of the many mines completely destroyed wilfully and systematically during the final retreat of the defeated Germans, even as late as October 28, 1918. The coal measures are overlain by water-bearing strata and quicksands, so that the shafts were sunk by special boring methods and lined with steel cuvellage; this was blasted with dynamite and the mines flooded. Of the 286 shafts 70 were dynamited, 172 are now filled with water, and 235 of the surface plants, magnificent steel structures built with the idea of permanency of operation, are partly, more often totally, destroyed. The few that escaped show the nature of the crime committed, for every building, every head-frame, bears a label giving the estimated quantity of high explosive necessary to wreck it. Many of the steel supports were cut by the oxygen flame and tumbled over into the already flooded shaft. The accompanying photographs tell the story better than words. Lens, the centre of the coal field, is completely destroyed and presents one

of the dreariest spectacles imaginable. Near Lens the little river of Souchez was turned into the mines and for part of its course has disappeared, now flowing through the underground workings. Between Bruay and Valenciennes there is widespread, deliberate, and malicious destruction. Bethune, Lens, Courriere, La Bassee, Douai, and other coal-mining centres, are crushed and crumbling ruins.

The problems of reconstruction, reparation, and rehabilitation are many. They are faced with a fortitude, courage, and determination equal to the gigantic task, and they will be solved. France has lost during the War 75% of her peace-time industries, the debts now aggregate three-fifths the total wealth of the country, her young man-power is sadly depleted and greatly exhausted, during the War the deaths exceeded the births by 800,000, but, while materially impoverished, France is morally strengthened, and moral energy is as important as material resource. Full restitution for the wrongs done is impossible except in so far as the allied powers combine to permanently wreck the national industry of Prussia—which was to wage war.

The peace treaty of June 28, 1919, gives to France Alsace-Lorraine, 5600 square miles, the frontiers to be as before 1871. In part compensation for the destruction of the coal mines, and as reparation, Germany cedes full ownership of the coal mines of the Saar Valley with their subsidiaries, accessories, and facilities. This is but a sop, for if France will beneficiate the additional iron ores of Lorraine she must purchase proportionately larger quantities of coal. The coal situation was menacing before the War; it is now aggravated. In 1913 it was necessary to import 20 million tons, and this when the Valenciennes field was giving its normal output. The whole product of the Saar mines in actual tonnage, saying nothing of the inferior quality of the coal, is not sufficient to offset the lack of coal from northern France. The Saar produces four grades of coal, none having the calorific value of the coals of northern France or of Westphalia. They can be used most advantageously for steam and domestic purposes but they are not good coking coals, one ton yielding little more than half a ton of coke, which is friable and of very inferior quality metallurgically. The Saar coal is sometimes referred to erroneously as the economic complement of Lorraine iron. Under German control the iron ores of Lorraine, the coal of the Saar and Westphalia, and the steel plants of all three districts, were treated more or less as a unit industry and most effective exchanges were made by means of the available cheap transportation. It is of vital importance to France that this exchange be maintained under intelligent government control; if coal from Westphalia is withheld the steel industry cannot expand, and either many of the iron mines will remain idle or a great surplus must be exported.

It would be presumption on the part of an American mining engineer to suggest improvements in methods or practice in French mining. The French engineers have long known their own problems and have solved them in accordance with their system of finance. Their mines are developed and equipped with the idea of permanent industry, and unless there is serious labor unrest and extraordinary advances in wage scales, the old French practice is peculiarly suited to French conditions. Their policy is progressive and there is constant search for new mineral areas or extensions of proved deposits. French Lorraine has greater reserves of iron ore than Lorraine Annexée and just before the outbreak of the War drill-holes had shown the extension of the coal measures of the Pas de Calais southward. Iron and coal are complementary minerals. France will have them both in larger quantity than in 1914, and when her reconstruction program is carried out, the steel industry will be among the first assets of a land that has suffered greatly.

Electrostatic Separation of Zinc Ores

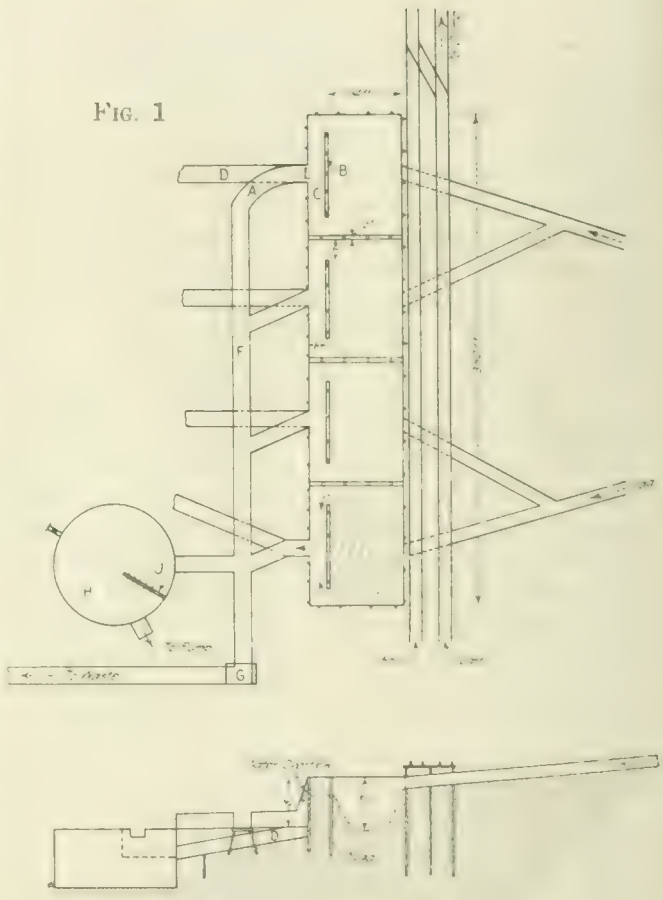
Electrostatic separation is one of the processes used for separating mixtures of sulphides of the same specific gravity that are not amenable to gravity concentration. Zinc-ore mixtures of pyrite and sphalerite in coarse crystals are often treated by this process. Such ore needs only drying before treatment on the electrostatic separator. The non-conductive mineral particles pass through the separator inert, but the particles of the conductive minerals acquire an electric charge and are repelled from one electrode. Sphalerite is a poor conductor or a non-conductor, and pyrite is a good conductor. Galena is likewise a good conductor and accompanies the pyrite. Fine dust cannot be treated on such a machine, its use being limited to the treatment of sand. As ores vary widely in their electrical properties, the only way of finding whether a given ore of zinc sulphide and other sulphides can be separated by this method is to test the ore in a commercial machine. With some ores electrostatic separation produces concentrate of commercial grade without further treatment, but as a rule none of the electrostatic or magnetic processes will make a clean separation of the average complex sulphide ore found in the inter-mountain States. The fact that pyritic ore does not have to be roasted before electrostatic separation is important, as the sulphur can be saved, if desired. If the magnetic-separation process were used, some of the sulphur in the ore would be burned off and would escape in the smelter gases, forming a nuisance. Another advantage of the electrostatic method is that mixtures of galena, pyrite, chalcopyrite, and sphalerite can be separated into one product containing the first three minerals mentioned and a second product containing the sphalerite. These two products can both be marketed to good advantage. The magnetic-separation process makes one product containing the iron and copper and another product containing the lead and zinc; and this latter mixture cannot be marketed to as good advantage as if the lead and zinc minerals were separated.—D. A. Lyon and O. C. Ralston in Bulletin 168 of the Bureau of Mines.

Method of Handling Granulated Slag at Anaconda

By OLIVER E. JAGER

When the Anaconda reduction works commenced operations in 1902, not the least among the noticeable features was the ample provision for the disposal of slag. Seventeen years operation, with increased tonnage during recent years, has altered this happy state of affairs, till at present, while it is true that there is still plenty of space on which slag may be deposited, there is no longer a free fall from the ends of the slag-launders. In seeking a solution of the problem, the adoption of elevators, conveyors, tailing-wheels, or other similar devices, presents some difficulty owing to the rapid rate of growth of the dump, which, under normal conditions of plant operation, must be arranged to receive about 3800 tons of granulated slag during every 24 hours. The system finally adopted may be regarded as a combination of the two standard methods of slag-disposal, namely, granulation and haulage. In brief, the granulated slag is run into settling-pits, where the water is separated from it, the pits being then excavated mechanically and the slag put into cars, which are hauled to the edge of the dump and emptied. Besides its simplicity, this method has the advantage that no machinery has to be moved as the dump grows larger, only the railroad track having to be swung out from time to time. Also, the dump being circular, the larger it grows the less frequently need the track along its edge be moved. The method is shown diagrammatically in the sketch, in which dimensions are approximations only. See Fig. 1.

FIG. 1



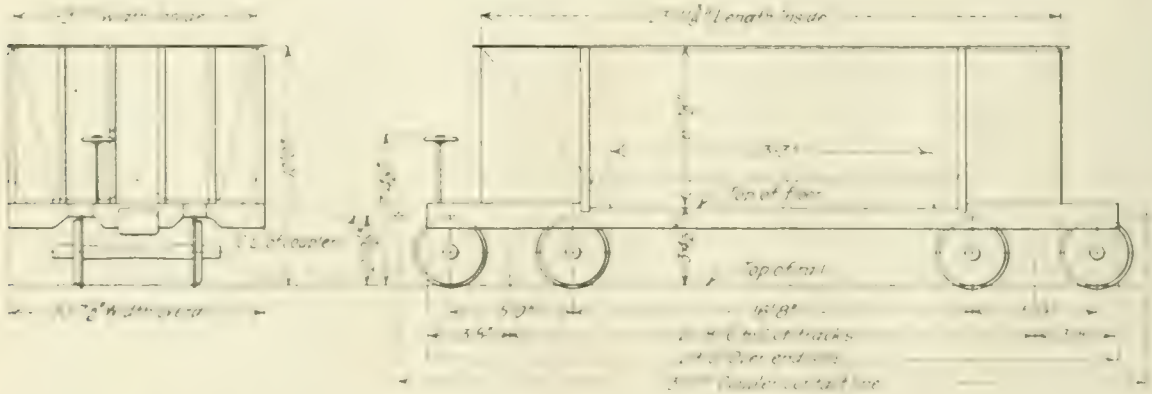


FIG. 2 SLAG-CAR

Two main launders, lined with reinforced slabs of slag, carry the granulated slag from the reverberatory building to the dump. These launders bifurcate at a convenient distance from the settling-pits, so that there is a discharge into each of the four pits. To prevent the stream of slag from channeling its way straight across the settling-pit to the exit-launders *A*, baffles *B* are placed about 6 ft. in front of the exits, thus causing the water to deflect and pass round the ends of the baffles. This arrangement provides good settling for the slag. The spaces *C*, between the baffles and the front walls of the pits, become filled with slag, which is removed only when it becomes troublesome. To do this, gates are opened to the launders *D*, which are placed below the launders *A*, allowing the slag to run directly to the dump. This is also a safeguard to be used in case of accident. As the slag fills the pit, boards are set in the exits *E*, to raise the level at which the water overflows, though this does not require much attention once the spaces *C* are filled.

EMPTYING GRANULATED SLAG FROM POTS

As originally built, there was one long pit only, but as it was found difficult to excavate the submerged slag, and also that the slag-water mixture had an abrasive action on the bucket-gear, the long pit was divided into four smaller ones of more or less equal size. Another difficulty in handling wet slag was that in winter there was an accumulation of ice on the cars and on the dump-tracks. Slag is allowed to run into two empty pits, one for each main launder, till they are filled to within 2 ft. 6 in. of the top, when the stream of slag is deflected to the other two. The water soon drains from the full pits, as there is no bottom to them, the whole structure being simply placed on top of the slag-pile in a manner to be described later. The hoist is then brought along the track nearest the pits, while the train of cars stands on the other track. The hoist is made by the Industrial Works of Bay City, Michigan. It has electric drive, and is capable of lifting 25,000 lb. at a radius of 30 ft. It is provided with a clamshell bucket of 3.5 yards capacity, with mild-steel edges, as the material handled is not hard enough to call for an edge of special steel. A bucket of larger capacity was first tried, but it was not successful. There are two such hoists in the equipment. The comparatively dry slag is easily excavated, a train of four cars (a total of 80 cubic yards) being filled in about 20 minutes. Excavation of the slag is carried to a depth of about 10 ft., leaving an outline somewhat as indicated in the sectional view.

The effluent water runs along the main launder *F*, through a mechanical sampler *G*, and then to waste. There is now in course of construction an installation for reclaiming this water, which, though not clear, is suitable for re-use in granulating slag at the furnaces. When this scheme is in service, the water from the pits will be deflected into a tank *H*, 50 ft. in diameter by 9 ft. deep, provided with a baffle *J*, reaching five or six feet from the top to cause the water to circulate and clarify before it overflows to the pumps. The tank has a pipe at the bottom for flushing out. The water will be handled by two 12-in. Cameron single-stage centrifugal pumps, each with a capacity of 5,000,000 gallons per 24 hours against a head of 160 ft. The pumps are direct-connected to 300-hp. motors running at 1800 r.p.m., and discharge into a machine-banded redwood-stave pipe of 18 in. diameter coated with tar and sawdust.

ROLLING-DUMP CAR FOR GRANULATED SLAG

The two lines of track beside the settling-pits are carried on 25-ft. piles driven into the slag. To form the back of the pits, two-inch planks are spiked to the piling

under the outside rail. Both the partitions between the pits, and the baffles, are made of piling and planks, the piles for the baffles being down 15 ft. only. The two ends and the fronts are not so heavily constructed, as they have less weight against them, 6 by 6-in. timbers being used instead of the piles.

The U-dump cars, into which the slag is loaded, are of a special design patented by Ernest Junghanns, a draftsman at Anaconda. As shown in the photographs, they dump by rolling to one side, the contents being shot out 3 ft. 3 in. clear of the track, thus obviating the necessity of cleaning the tracks after each train is dumped. Dumping is performed by admitting compressed air into the cylinder attached to the under-side of the car-frame. This cylinder is hung on trunnions to allow of its turning as the car dumps. It is fitted with a telescopic piston the two members of which are of 15 and 7¾ in. diameter respectively, with strokes 1 ft. 10 in. and 1 ft. 6 in., or a total stroke of 3 ft. 4 in. The cars dump with ease, owing to the nicety of balance, and the car-body resumes its original position by gravity when the air-pressure is released. Compressed air for dumping is piped along the train from the locomotive, and each car also has a container holding sufficient air for dumping in case of accident. The cars are of 20 cubic yards capacity; nine cars are provided.

Westinghouse electric locomotives, weighing about 30 tons each, are used to haul the cars. There are two of these locomotives in the equipment, and each carries an air-compressor plant consisting of three compressors of type D4, made by the Westinghouse Traction Brake Co. These provide the air necessary for dumping the cars, operating the spreader, and for braking the train. A fan is also carried for cooling the traction motors should over-heating occur. The pressure of air is automatically maintained, the high and low limits of the control being 130 and 90 lb. respectively. A Jordan spreader is included in the equipment, as it is necessary to plow off the edge of the dump from time to time as the slag piles up. This machine operates by compressed air. 500 volts D. C. is taken from a third rail beside all tracks except that next the pits, where it would be unsafe on account of operating the hoist, so the latter machine is fed by a cable. The dumping-track is of circular form, and is at present about three-quarters of a mile around. As the edge of the dump extends, the track must, of course, be cut and moved farther out, to facilitate which gaps are left at intervals in the third rail, connection being made between the rail ends by a piece of cable having plenty of slack. As the track is moved out the gap widens, till it finally grows too large for the locomotive collecting-shoes to bridge over, when another piece of rail is put in and a gap left elsewhere. The third rail is protected by a wooden box, which is also in sections to facilitate moving. The dump-tracks are of 60 lb. rail, and are well maintained. A repair shop for all this equipment has been erected on the dump itself.

For the blast-furnace slag there is a smaller installation consisting of two settling-pits situated at another part of the dump, but whose tracks connect to the circular dumping-track and to the rest of the system.

The sloping face of the pile of granulated slag, on the side next the Butte, Anaconda & Pacific railway, is prevented from slipping by putting in rows of fencing made of planks spiked to posts set in the slag. Any movement of the granulated slag on this side would tend not only to cover up the railroad-tracks, but would also endanger the pits and launders on top of the slag-pile.

Bureau of Public Works

Seventy-one delegates, representing 74 organizations with a membership in excess of 105,000, recently attended a conference of technical societies in Chicago. It was called by Engineering Council, and unanimously adopted a resolution urging Congress to establish a Department of Public Works. Among the activities that logically belong to such a department are the following:

Bureau of Public Roads; the United States Reclamation Service; the Alaskan Engineering Commission; the Construction Division of U. S. Army; a Bureau of River, Harbor and Canal work, including such functions as are now exercised by the Mississippi River Commission and the California Debris Commission; a Bureau of Architecture; a Bureau of Surveys, including the Coast and Geodetic Survey; a Bureau of Mines; the Geological Survey; the Forest Service, at least until the same is divorced from the supervision of water powers and road building; and the Bureau of Standards.

Later the following resolutions were adopted unanimously:

Resolved, That this conference be known as the Engineers, Architects, and Constructors Conference on National Public Works; that it continue in existence until dissolved by its own action and that its officers and committees be empowered to further the organization and development of a National Department of Public Works.

Resolved, That for the purpose of furthering the passage of a bill for the creation of a National Department of Public Works there be set up by this Conference an Executive Committee, a Committee on Text of Bill, and a Campaign Committee. The Executive Committee shall have the power to create a Finance Committee and other committees and to add to its own membership or to that of its committees.

Resolved, That the facts be presented to the President and to the Congress, and that they be urged to make adequate provision for the entire work of completing the topographic map of the United States in the shortest possible time compatible with requisite accuracy; and inasmuch as Engineering Council has already taken up this matter with Federal Government Departments, their efforts to hasten the completion of the topographic map be endorsed by this Conference and that this resolution be entrusted to them to present to the President, the Secretary of the Interior, the members of the Congress, and to make such other disposition of it as will, in their judgment, further the end desired.

Technical Writing: Slovenliness

By T. A. RICKARD

*Slovenliness is as disgraceful in words as in clothes. Much writing that we recognize as poor in style is merely sloppy. Just as some students postpone the necessary shave or forget to change their collars, so young engineers drop their articles, definite and indefinite, or omit prepositions where they are required, as if to compensate for those they use unnecessarily.

(1) "[During] the preceding summer I went to Nevada."

(2) "The work will begin [on] Saturday."

(3) "Flotation in America [during] the last two years has made tremendous strides."

(4) "All such work helps [to] solve the problem of efficiency."

The sign of the infinitive should not be omitted; this is a common blunder. In the June 'Atlantic', Vernon Kellogg writes: "And it includes the thought that such justice is needed *to help bring* the light into the dark places of this world."

(5) "At first the work was interesting and [was] liked by most of the men."

The verb 'be' is used both as a principal and as an auxiliary.

(6) "The drop of *crusher lubricating oil* could not get into the bin and mix with the ore."

The adjectival use of nouns leads to a jumble; he means

"The lubricating oil on the crusher could not drip into the bin and mix with the ore."

(7) "Construction of the mill started [on] August 12, 1915, at which time *75%* [three-fourths] of the excavation was completed."

Abridgements that leave the reader to guess the writer's meaning are bad. Mr. Roosevelt writes:

(8) "While camped on the 'Nzoi, the honey-birds were almost a nuisance."

Mr. Roosevelt and his party, not the honey-birds, were camped on the 'Nzoi. Such elliptical phraseology is slovenly.

Do not omit the connecting pronoun.

(9) "Their vein is not as wide, nor the ore as rich, as the Combination."

"The vein in their mine is not as wide, nor the ore as rich, as that in the Combination."

(10) "Many mining booms such as [those of] 1906 and 1916."

(11) "A rate of drilling much superior to [that of] the old piston-drill."

A finite verb must agree with its subject, says the rule.

(12) "One of the most brilliant contributions to geology that *has* [have] been made."

The correct form sounds awkward; the attractive form is wrong; avoid both. The clause "that has been made" is redundant.

(13) "Any one can measure with a glance, when *they are* tired."

Ruskin, who wrote this, meant 'when he is tired' or 'when tired'.

Participles are commonly misused by novices. The dangling of a participle at the beginning of a sentence contravenes the rule of grammar that the substantive to which a participle relates must appear in the same sentence. For example.

(14) "Approaching the vein, the serpentine is seen to be decayed."

"As we approached the vein, we observed that the serpentine was decayed."

(15) "Examined carefully no fossils were detected."

"Although I examined the rocks carefully, I could detect no fossils," or "Although the rocks were examined carefully, no fossils were detected."

(16) "Turning westward there is a striking change."

"Turning westward the observer beholds a striking change."

(17) "In going seaward the boulders become smaller."

"Toward the sea the boulders are smaller."

Even practised writers are frequently guilty of the error of using participial phrases having no logical relation to the clauses preceding. Thus:

(18) "The sandstones are massive, occurring chiefly in the lower half of the formation."

"The sandstones, which are massive, are chiefly in the lower half of the formation."

(19) "The output of the mine is about 100 tons daily, its assay-value being $50."

"The daily output of the mine consists of 100 tons of ore, averaging $50 per ton."

Another misuse is illustrated in the sentence:

(20) "The vein has a general width of 1 to 6 inches, *widening* [but] in places [it widens] to 12 inches."

Here the participle is used as an adversative, or contradicting, term.

(21) "The limestone *occurs resting* [rests] upon the quartzite."

(22) "These dikes *were found cutting* [cut] the granite."

(23) "The cliff *rises facing* [faces] the river."

The choice of the wrong subject-nominative leads to wordiness:

*Another chapter from the forthcoming book on 'Technical Writing,' to be published by John Wiley & Sons, New York.

(24) "*The drainage of* the area is *accomplished* [drained] by three streams."

(25) "*The collection of* the statistics *is done* [are collected] by correspondence."

Delete the first three words in each of the two foregoing sentences.

(26) "*Confirmation of* these reports cannot be *obtained* [confirmed]."

As says Mr. George M. Wood,[1] from whom the three preceding examples are borrowed:

"The writers of these sentences, having 'used up their verbs' in their subject-nominative, could find no suitable predicate-verbs and were compelled to employ instead more auxiliaries or inappropriate words."

The use of 'due' at the beginning of a sentence in the sense of 'attributable' is a common error, for the reason that a causal phrase, which is adverbial, should not be introduced by an adjective.

(27) "*Due* [owing] to the *psychological* attitude of *labor* [Labor] and the scarcity of skilled operatives, it is far more difficult than ever before to secure high efficiency."

Delete "psychological", which is redundant.

(28) "Such problems are nearer solution, *due* [thanks] to the researches of Bragg and others."

(29) "This is explained by the fact that this substance, *due to* [in consequence of] the predominating effect of the calcium, coagulates the slime."

(30) "*Due to* the nature of the ore, it is expected to obtain a smelting ratio of seven of ore to one of coal."

Here 'due to' stands for 'in consequence of' or 'owing to'. Again:

(31) "*Due to* the rise in copper, many mines are being re-opened in this district."

Those who fall into this bad habit are also likely to begin their statements thus:

(32) "*Indicative of* the success of the method is the cost which is now 60 cents per ton."

This can be improved:

"The success of the method is indicated by the low cost, which is now only 60 cents per ton."

'Tend' is a word that prolongs a sentence without adding to the sense. Many writers enfeeble a verb by inserting the superfluous 'tend'.

(33) "The use of flotation *tends to aid* [aids] the saving of copper in chalcocite ores."

(34) "Such methods *tend to cheapen* [cheapen] the operation."

Unemphatic words at the beginning of a sentence usually precede roundabout statements:

(35) "*Because* the surface tends to contract with a definite force does not mean that it is coated with anything like a rubber membrane."

It would be better to write:

"The fact that the surface tends to contract with a definite force does not prove that it is coated with anything like a rubber membrane" or "The tendency of the surface to contract etc."

Here is another example of a poor beginning:

(36) "*By* such a system I believe we could establish a foreign trade based on honesty of goods *which* other nations would find it hard to take from us."

Here 'by' is a weak introductive. He means:

"Such a system, I believe, would serve to establish a foreign trade so well based on honesty of goods that other nations would find it hard to compete with us."

'While' is another little word much misused. Instead of being restricted to its primary function as an adverb of time, it is employed as a conjunction synonymous with 'whereas', 'though', 'but', or 'and'.

(37) "*While* [whereas or although] coal and iron command high prices, oil has become cheaper."

(38) "At some points the ore is 4 feet wide *while* at others it narrows to 6 inches."

Insert a semicolon after "wide" and delete "while".

'Along these lines' and 'along this line' is a common crudity. It is neither precise nor clear.

(39) "Examinations *along these lines* were made every year."

"Examinations of this kind (or for this purpose) were made every year." Perhaps "similar examinations" would express the meaning, which is still left in doubt.

(40) "The development of the mine *along this line* is sure to prove successful."

"The development of the mine in accordance with this plan is sure to prove successful."

(41) "Investigations *along* petrographic *lines* are not needed."

"Petrographic investigations are not needed."

'Occur' and 'occurrence' are over-worked, especially by geologists. They are words to be used sparingly.

(42) "The other *mineralogical occurrence* [mineral] I found in the Gila Canyon Consolidated Copper Co.'s mine."

He is referring to another mineral, not to another find of the same mineral.

(43) "There are seldom any signs of secondary copper enrichment, unless it be the occasional *occurrence* along cracks of pyrite."

He means: "Signs of sulphide enrichment are rare, except where the pyrite has been deposited along cracks." "Occasional occurrence" suggests time; he means place; here and there the pyrite was detected by him along the cracks. "Cracks of pyrite" is a bad phrase.

(44) "The gold *occurs* [is] distributed over a large area."

(45) "The fluorspar mines *occur* [are] in Pope and Hardin Counties."

Usually 'occur' takes the place of a word that is more specific.

(46) "Hardwood trees *occur* on these slopes."

The word he needed was 'grow'.

[1] 'Suggestions to Authors', by George McLane Wood. U. S. Geological Survey. An extremely useful pamphlet.

(47) "In parts of the mine where the fault *occurs*, the veins are shattered and impoverished."

He means that where the veins are crossed by the fault they are shattered and poor in gold.

(48) "The telluride *occurs in* [lines or encrusts] *the interior of* the cavity.

A 'cavity' is a void, considered with reference to the circumjacent material. "The telluride encrusts the cavity."

(49) "Underlying this decomposed garnet in the formerly barren crystalline lime [are] the secondary zinc ores *occur*."

Delete 'occur' and end the sentence with a significant word.

Writers who overwork 'occur' are likely to introduce their statements with 'there is' and 'there are', both of which are poor locutions—the mere tuning of language.

(50) "Wherever the galena occurs *there is* an increase of silver in the ore." The man that wrote this failed to say where or how the galena was distributed in the lode or vein, and thus omitted a necessary item of information.

"Wherever the galena is seen, there the ore is richer in silver."

(51) "Small packages can be easily carried and *there is* not the incentive to drop them by the carriers." This can be amended thus:

"Small packages can be carried easily, therefore the carriers are not tempted to drop them."

(52) "*There are* few Cornishmen employed at Treadwell."

(53) "I question whether *there is* any probability of succeeding with this process."

These statements may be improved thus:

"Few Cornishmen are employed at Treadwell."

"I question whether the process can succeed."

(54) "*There are* more men killed in metal-mining in the United States, in proportion to the number employed, than in the country's coal mines."

Here 'there are' merely detracts from the force of the statement; start with "More men are killed" and note how much more direct and forceful it is.

'It is' belongs in the category of feeble introductions.

(55) "*It is the belief of* the miners that the ground now worked may be a slide."

"The miners believe that the ground, etc."

(56) "*It is* a sign of richness in gold when the quartz is ribboned."

"The ribboning of the quartz indicates richness in gold."

Begin and end a sentence with an emphatic word, as far as may be practicable without stilting the phraseology.

Avoid redundancy. In the following examples the italicized words should be deleted:

(57) "The railway should be finished in nine months *time*."

(58) "It requires several weeks or months *time* to treat the ore."

(59) "The mine is three miles *distant* from the mill."

(60) "Timbers are set *at a distance of* 4 ft. 2 in. centre to centre."

(61) "The peak is 12,750 ft. *high* above sea-level."

(62) "Manganese *at present* can be precipitated at the same time as the iron."

It must be present in order to be precipitated.

(63) "It is best to use zinc sheets 2 feet by 3 feet *in size*."

Do not attempt to be impressive by piling one word on another.

(64) "Records were started with this *ultimate* end in view."

(65) "He cannot return home before the *final* completion of the mill."

(66) "This oil will serve *equally* as well as oleic acid."

(67) "The roasting will require *probably* about seven hours time."

Study the meaning of words so that you will not employ 'evince' or 'evidence' when you mean 'show'; 'phenomenal' when you mean 'extraordinary'; 'transpire' for 'become known'; or 'problematical' for 'doubtful'. As you obtain literary taste, you will abhor 'advent' as a synonym for 'introduction' or 'arrival'; 'situation' for 'state'; 'eliminate' for 'extract', 'avoid', or 'destroy'; 'proposition' for 'proposal'; 'contemplate' for 'plan' or 'intend'; 'balance' for 'compensate'; and 'unethical' for 'improper'.

(68) "The stamp-mill held its own until the *advent* [introduction] of the cyanide process."

(69) The treatment of the pyritic copper ores awaited the *advent* [application] of modern smelting methods."

(70) "The *cyanide situation* [scarcity of cyanide] in Northern Ontario."

(71) "A tramway will be built around Mineral lake to *eliminate* [avoid] the use of barges.

(72) "The *proposition* [proposal] made by the union was rejected."

(73) "The erection of one smelter and the completion of others now *contemplated* [planned or proposed]."

(74) "It would be *unethical* [improper] to disclose my reason for withdrawing from the case."

(75) "The natural expectation would be that *they* [each] (Carranza and Villa) *will each* [would] start *in* to *eliminate* [destroy] the other."

No man with a right feeling for language would be guilty of such lapses. Acquire good taste by reading good literature: Huxley and Spencer, Thoreau and Lowell. Read 'The Atlantic Monthly', not 'The Saturday Evening Post'; read 'The Outlook', not 'Hearst's Magazine'.

If you read only second-rate stuff, you will lose the taste for good English, and the quality of your own writing will suffer, until you may be guilty of such lapses as the following:

(76) "There are companies arranging to install commercial size units of several new inventions. It is far from probable that all these schemes will prove successful and therefore one anticipates hearing of disappoint-

ments experienced by the pioneers in this work."

He may have meant to say:

"Several companies are arranging to erect working units based upon new inventions. It is unlikely that all these schemes will prove successful, and one may anticipate that the pioneers will suffer many disappointments."

(77) "In practically every instance, operators plan to make the fuel item a self-contained proposition."

He is speaking of oil-shale, and he means:

"Most of the operators plan to use the shale for fuel."

(78) "These often contain cassiterite, sometimes in profitable quantities, but long before the water sorted gravels are reached the wolfram has disappeared, though it comes from the same lodes as the tin ore where it almost invariably occurs in considerably greater quantities."

Probably he meant:

"In many localities these alluvial deposits contain sufficient cassiterite to be mined profitably, but long before the water-sorted gravel is reached the wolfram has ceased to appear, although it is derived from the tin-bearing lodes, in which it is invariably the predominant mineral."

That may not have been his meaning; the worst of such writing is not its ungainliness but its obscurity. It may not be intended to be beautiful, but it certainly is intended to convey information, and in that it fails.

(79) "In a cross-cut on the 14th level in ground to the east of the main drift along the line of the larger ore shoot a vein of quartz was struck, which on being followed soon developed values, and further on extraordinary values."

Would you think of engaging the services of an engineer showing so little intelligence? He may have meant to say:

"On the 14th level a cross-cut going eastward from the main drift, that is, the one along the line of the larger ore-shoot, struck a vein of quartz, which, on being followed, began to show ore and a little farther yielded ore of extraordinary richness."

(80) "There has never been any doubt that the problem of dry concentration would some day be solved and its present successful *advent* should not be passed by without at least an investigation."

Was it the "advent" or the "problem" that merited attention? How does one 'pass by' an 'advent' even in the dark?

"It never was doubted that dry concentration would some day prove successful, therefore this latest experiment is well worthy of attention."

Use words so that each one may be significant. We keep different tools for different kinds of work, thereby gaining efficiency. Keep each word to its allotted task. Do not dull the edge of a chisel by using it as a screwdriver.

'Differentiate' refers to a physical process of becoming different; it is not a correct synonym for 'discriminate' or 'distinguish'.

(81) "It would not be fair to *differentiate* [discriminate] against him."

'Designate' is to specify or particularize, not to choose, appoint, or name.

(82) "He *designated* [appointed] Jones foreman."

'Visualize' is to make visible, not to imagine, see, describe, or illustrate.

(83) "He was unable to *visualize* [imagine] the horrors of War."

'Discount' is to deduct from an amount or make allowance, not to expect, anticipate, or offset.

(84) "The manager *discounted* [anticipated] the caving of the stope."

These examples should serve as warnings to the engineer, who nowadays makes a fetish of efficiency and writes articles upon it in ineffective language.

An American provincialism that is gaining ground is the use of a geographic noun as an adjective, thus:

(85) "A *California* [Californian] mining engineer."

(86) "The *Alaska* [Alaskan] method of drift mining."

Our daily papers show such head-lines as 'Good Italy Harvest'; 'Great Albania battle'; 'U. S. Victory'. In these the corresponding adjective is desirable: Italian, Albanian, American. Undoubtedly newspaper usage is corrupting; technical writers should take care not to copy the habits of the illiterate.

Careless writers, with a fondness alike for the abstract word and the unnecessary plural, also show a preference for vague terms when precise ones are available. They use the present participle of a verb in place of the noun itself; thus

capping	instead of	cap
cropping	"	" outcrop
filling	"	" fill
faulting	"	" fault
heavy stulling	"	" big stulls

(87) "A *capping* [cap] of leached monzonite covers the ore."

(88) "There *are* [is] no *cropping* [outcrop] of the vein to guide the prospector."

(89) "The *fillings* [fill] in the old stopes can be milled at a profit."

Abstraction is carried to inanity by scribblers who change

nations	into	nationalities
authors	"	authorities
events	"	eventualities
persons	"	personalities
characters	"	characteristics

"It is well to look askance at words ending in 'ism', 'istic', and 'ization', for "they come of a vacuous tribe."[2]

Technology knows no political boundaries. The part of it written in English goes round the world. We exchange freely with the British and their cousins overseas. The English language is the common heritage

[2] Allbutt. Op. cit. Page 144.

alike of the American and the Briton, both of whom debase it with vulgarisms and colloquialisms that are understood only locally or regionally. In order that technical literature may pass current wherever our language is spoken, and even in foreign countries where it has to be translated laboriously, it is our duty to discard local terms or provincial phraseology. For example, 'reef' as used for 'lode' in Australia and 'ledge' as used for 'vein' in California are both objectionable terms. An orebody underground has no resemblance to the rock that imperils navigation, nor does a vertical outcrop resemble a shelf.[3] The Australian put his 'mullock' [waste rock] in a 'paddock' [enclosure] while the American puts his 'dirt' [ore] in a steel 'tank' [bin]. The 'mullocker' at Bendigo is equivalent to the 'mucker' at Tonopah, and each is a 'shoveler' in good English. I need not multiply examples of bucolic terms and incongruous localisms. They disfigure technology and obstruct scientific thought. Why should a scientific man—for that assuredly describes the mining engineer—go to the illiterate workman for his terms? If you wish to learn how to break rock ask the Cornish or the Italian miner, by all means, but if you wish to use the delicate instrument of expression accurately ask those who are trained in the art. As graduates of a university you are expected to obtain your terminology from the library, not from the stope; you should shape your phraseology on that of the college, not on that of the bunk-house.

(90) "These *tanks* [steel bins] have proved satisfactory, especially to the mill-men, who are relieved of all ore-bin *mucking*."

He means that they are relieved of the labor of shoveling inside the ore-bin.

Such adoption of local vulgarisms by careless writers may be defended by shallow critics as one phase of that absorption of new elements by which a language grows. Of course, the English language is a living organism fed continually out of the varied human experience of our peoples—the American and British predominantly, but also the others who speak it across the seven seas. All of which in no wise excuses a literate engineer in displacing recognized technical terms by half-baked provincialisms.

To write well you need self-restraint—a grip on yourself. The notion prevails in some quarters that it is effeminate to use words with nicety, that the practical man is expected to fling them about him with careless vigor. That is a mistake. An educated man is disciplined in words as in conduct. Indeed, the self-discipline of writing is a splendid training for any engineer. It teaches him how little he knows accurately, and spurs him to gain a more thorough understanding. The turbid pulp in a mill is made clear by passing through classifiers and settlers, so that the metallic particles are separated as a clean assorted product. Similarly ideas, odds and ends of information, stray bits of observation, if passed through the mind in the act of writing are co-ordinated, classified, and systematized into workable shape, into definite form, ready for immediate use.

In technology we should try to keep each term for a specific duty.

'Locate' and 'location' should be restricted to the delimiting of a claim. If we use these words in other senses, we cause confusion.

(91) "He *located* the mill on Deer creek."

Did he 'locate' a mill-site or did he build a mill on the creek?

(92) "The superintendent *located* [found] the ore-shoot on the fifth level."

(93) "He is now *located* at Silverton."

"He lives at Silverton now."

(94) "The mine is *located* in Northern Rhodesia."

Delete 'located', or substitute 'situated'.

'Carboniferous' and 'carbonaceous' have different meanings. They should not be used interchangeably. 'Carboniferous' referred originally to the geologic division of time associated with the formation of coal, but all Carboniferous strata do not contain coal. It is now simply the name of a geologic period, and is given a capital 'C'. 'Carbonaceous' means carbon-bearing, or containing carbon; it may be used to describe a black shale. A rock may be both Carboniferous and carbonaceous, as in Missouri, where a limestone belonging to the period immediately succeeding the Devonian is black with the product of decomposed vegetal [not 'vegetable'] remains.

'Calcining' and 'roasting' are not synonyms. The first should be applied to a process for removing carbon di-oxide from carbonates, such as limestone, or for dehydrating a hematite ore; the second should be restricted to a process for the expulsion of sulphur by heat in the presence of oxygen.

'Tank' is a term sadly over-worked. It means a large vessel used for storing liquid. A large vessel employed for conducting a chemical process may better be called a 'vat'. This distinction is not often observed, but it can be made to advantage in technical writing. Lately the word 'tank' has been used for a cylindrical steel ore-bin. This use only serves to confuse. An engine of war lately devised has been called a 'tank', although it is more like a glyptodon or some other monster of the primeval slime. We can forgive the men in the trenches anything, but not the metallurgist that calls an ore-bin a 'tank', as if in mockery of these dry days.

A 'chute' is a sloping passage down which material is passed; a 'shoot' is an orebody of recognizable shape and inclination in a lode.

Those who consider such distinctions of no consequence will call a machine for getting rid of slime a 'slimer', ignoring the fact that the suffix 'er' indicates an agent, so that a 'slimer' is a thing that makes slime. The process of 'de-sliming' is conducted on a 'slime-table'. The same scribbler would talk of 'dewatering' a shaft, ignoring the fact that we use 'unwater' to signify that operation, while we use 'dewater' to indicate the removal of

[3] A 'ledge' of oil-shale is correct, because the shale is nearly horizontal and projects from the face of a hill like a shelf.

excess water in a pulp. Again, consider the difference between 'recovery' and 'extraction'. In subjecting a copper ore to concentration the percentage of the copper in the concentrate is a 'recovery', but it is not an 'extraction', for that is the work of the smelter. By using technical terms thoughtfully we increase our vocabulary; the careless use of words means the loss of distinct meanings; on the other hand, the discriminating use of words assists accurate expression.

'Section' is often used improperly. A section is a division of the public land containing 640 acres. It is also the view along an imaginary slice of anything, like a geologic section or the section of a machine intended to exhibit the interior. We ought not to use it as a synonym for 'region', 'district', or 'locality', as in:

(95) "The South-West is an arid *section* [region]."

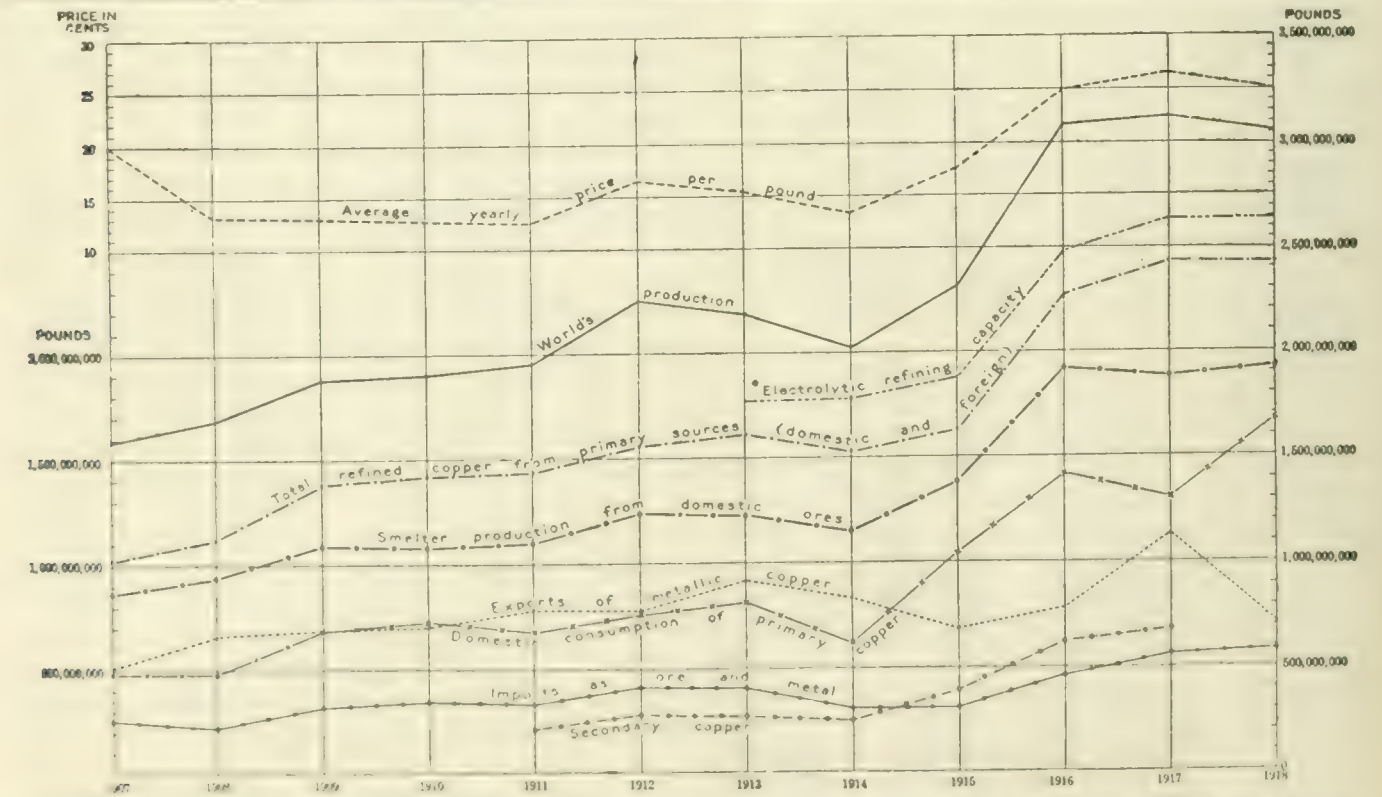
(96) "In this *section* [district] the mines produce gold only."

Engineers should keep technical words for appropriate uses, otherwise they lose their special significance. A 'tunnel' is a gallery or bore that goes through a hill or mountain from daylight to daylight, as a railway tunnel does. A level that enters a mountain from the surface, to become the main artery of a mine or to drain the water from the underground workings, without going through to the other side of the mountain, is an 'adit'—a technical term used by miners from time immemorial.

It is well to note that mistakes are rarely solitary; like sorrows "they come not single spies, but in battalions." Let me impress upon you the fact that if you are careless about one detail—apparently unimportant—you are likely to take no thought about others. Whether or not you accept my dictum concerning the use of this or that word or the rejection of this or that method of statement is of minor importance as compared with your acceptance of my general argument: that it is worth while to use words precisely and to build sentences logically. The man that learns to master the little words will acquire mastery over the big phrases. Genius has been called an infinite capacity for taking pains. The definition is incomplete, but it recognizes the first requisite of all good workmanship: the effort to be thorough.

MINE TIMBERS are subject not only to insect attack, but also, what is more important, to the action of gases and fumes that customarily occur in mines. These different destructive agencies cause the decay of the wood, and as a result it is only six or seven years, on an average, before such timbers become so weakened that constant repairs are necessary, even if they do not need to be replaced. It has been found that the life of the timbers can be doubled and even trebled by coating them with a creosote compound that fills all the pores on the surface of the timber and thus prevents gases and fumes from reaching the wood. The coating is a simple process, is not expensive, and tends to eliminate repairs to the timbering of shafts and other mine passageways that have a comparatively long life.

ANACONDA output of copper for June amounted to 10,500,000 pounds, against slightly in excess of 24,000,000 for the corresponding month of last year.



CURVES SHOWING THE PRINCIPAL FEATURES OF THE COPPER INDUSTRY FROM 1907 TO 1918. THE FIGURES FOR SECONDARY COPPER IN 1918 ARE NOT YET AVAILABLE

Carnotite in the Gateway District of Colorado and Utah

By DWIGHT FARNUM

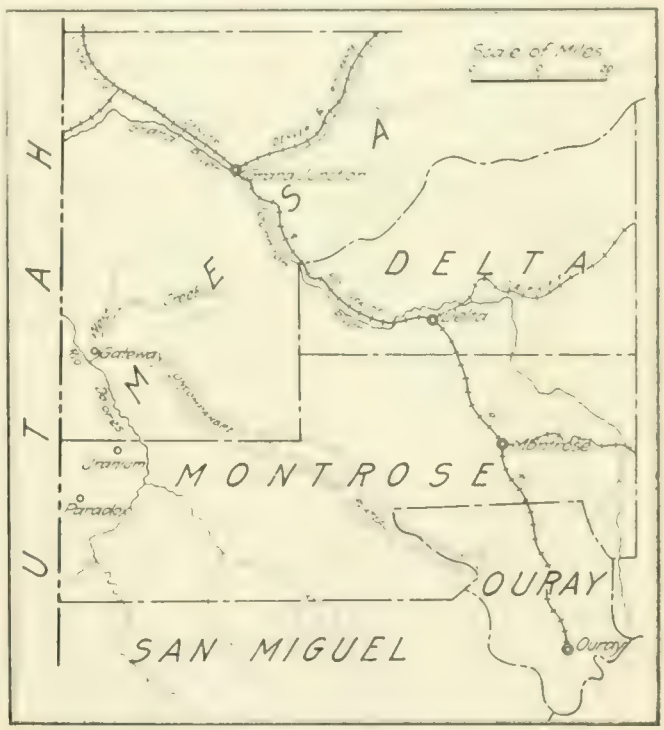
Gateway, in Mesa county, Colorado, is merely a post-office at a ranch situated in the valley of the Dolores river, near the mouth of its tributary, West creek. The valley, and consequently the surrounding country, which I will designate as the Gateway district, is practically virgin because I was told that the first white settlers entered the valley less than twenty years ago. The post-office is the terminus of an automobile stage-line operating from Grand Junction and Whitewater, both in Colorado, on the Rio Grande railroad.

The Gateway district covers an area of about 15 miles square, extending into Utah as far as the Beaver Creek rim, and consists chiefly of high mesa, having a topography of successive terraces cut deeply here and there by canyons and dry gulches, all of which lead down to the Dolores river. It is an arid tract, every one of the few springs being well known and protected from destruction by wild animals or cattle. There are small areas of a dense growth of piñons and cedar.

Briefly, the geological formation of this district is sandstone of a calcareous nature in the upper strata and ferruginous in the lower, and a silicious limestone. There are three distinct strata of sandstone and the lower dark red stratification being exposed near the valley-level assumes many striking appearances. One of these is a natural double gateway, of vast proportions, through which the Dolores river and West creek flow before uniting. From a point upon the mesa, the view down one of the canyons is of indescribable beauty, as the intense green of the valley is framed within the dark-red perpendicular walls of the Gateway.

Carnotite is the only mineral exploited in the district and although it is associated with the three principal sandstone strata, the most important deposit is the one associated with the middle one, known as the La Plata sandstone. The ore occurs in blanket formation, slightly inclined from the horizontal; it averages two and one-half feet in thickness and lies just above the limestone. It is practically a contact deposit and underlies the whole district. This impregnated sandstone is not uniform in character or quality, and therefore cannot be mined 'just as it comes', nor without considerable experience. The ore rich enough to ship occurs in pockets, as is characteristic with most infiltrated formations. A pocket has been known to produce a carload of commercial ore, but most of them will yield a few sacks, or a ton at most. A miner may do days of 'dead work' after cleaning out a pocket and suddenly open up another, while on the other hand a few shots may expose another pocket of large or small proportions. The ravines cutting the strata throughout the district expose the same ore-formation for miles and it is along the outcrops that the claims have been staked and the prospect-holes and tunnels have been driven. The sandstone is easily worked, though hard on steel and picks. Light blasting is required, the lower grade ore, including some limestone, being removed underneath while the richer grade is picked down upon canvas to save the fine.

The ore is generally of a dark-brownish appearance, colored here and there with light-yellow patches and streaks along the seams and cracks showing the result of



MAP OF PART OF COLORADO

changes due chiefly to weathering. Color does not seem to be a desirable means of estimating the contents of the ore, as similar pieces have shown widely varying percentages of uranium and vanadium.

Unfortunately the man accompanying me, and for whom I sampled several workings, insisted on mailing the samples to his office. I learned that the "pretty pieces" had been analyzed and distributed to the public. Therefore I cannot give the reported results, as they are of no value. However, I estimate from what I learned through talking with the several persons engaged in mining and shipping the ore that it will average 2% U_3O_8. I was told that the vanadium ore, so-called, averaged

4% V_2O_5 but was thrown over the dump, as the buyers would not take it, and that 10% U_3O_8 and 8% V_2O_5 were often found.

Most of those engaged in the industry are ranchers, who develop their claims between times, getting out small sacked shipments occasionally, but at present they are at the mercy of the ore-buyers, who represent either Eastern firms, a Western sampling-works, or some unprincipled promoter. These miners, who operate in a small way, told me that the ore-buyers make a pretense of abiding by "fair sampling" of the shipment, (a grab sample is taken out of odd sacks in the presence of the shipper at Whitewater, Colorado, on the D. & R. G.). The buyer pays an estimated percentage, cash, to the shipper on the uranium content of the ore, but no consideration is taken of the vanadium content, much to the profit of the ore-buyer. The final payment is made on the buyer's analysis.

The so-called mines are 7 to 15 miles from the Gateway post-office, where the ore is brought in sacks by pack-train over difficult trails and stored, for shipment by automobile 47 miles to Whitewater.

It appears, from the pockety nature of the ore, which necessitates a large amount of dead work; from the fact that portions of the outcrop have been covered by slides; from the great distances, the scarcity of water, and the present means of marketing the ore, that carnotite will not be mined by individuals or companies on a large scale in this district except as a means of obtaining the ore for individual use, as is done at present by two or three companies whose operations have not reached large proportions, but generally have begun with an open-cut, with continued sliding and caving, until a method of tunnelling similar to the room-and-pillar of coal mining has proved necessary on account of the depth reached in following the ore.

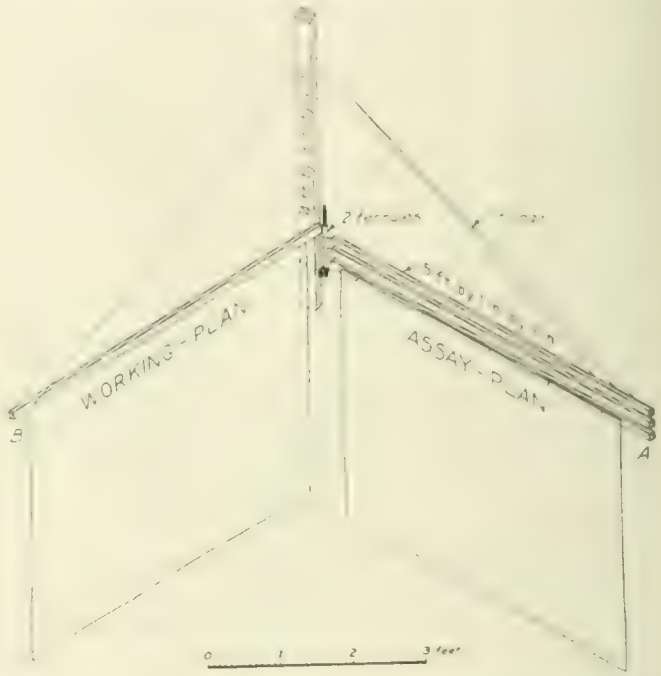
If the different individuals who own claims and all those interested in mining carnotite in the Gateway district would co-operate, and form an association, they could get out their irregular shipments and employ an agent to protect their interests so that the ore could be properly sampled, sold for the double content, and shipped in carload lots. Such an association would attract other small operators into the district. Mining of this nature is similar to 'pocket-hunting' in California, for it can be engaged in intermittently with profit, because no great amount of capital is tied up and the co-operation of the small miners and prospectors would ensure a respectable tonnage of ore.

A TOTAL of $5,031,500 in gold coin has been withdrawn from the subtreasury for shipment to foreign countries. Gold coin to amount of $1,200,000 in addition to that previously reported as withdrawn from subtreasury has been withdrawn for shipment to Spain and $156,500 in gold coin to South America. Total withdrawals of gold coin from subtreasury and gold bars from United States assay office aggregate $91,643,000 since gold export embargo was lifted.

A Hanger for Plans and Maps

By H. E. CLAYTON

The survey office in which I was working had a small amount of space available, and when it became necessary to examine several plans at once, the task was difficult. Consequently the plan-hanger shown in the sketch was devised and fitted with blueprints of all plans in current use. It carries a large number of plans (twice the number of sticks that can be placed on the iron pin), and



has the merit of folding up compactly against the wall when not in use.

The principal support is a piece of 3 by 2-in. timber 4 ft. long, which is affixed to the wall. An iron pin $\frac{5}{8}$ in. diam., with two shoulders shrunk on, is made as shown in the sketch; this pin, being threaded at the lower end, is bolted through the timber six inches from the end with one shoulder bearing against the wood while the other serves as a support for the screw-eyes in the ends of the sticks that carry the plans. The sticks are one inch square and of a length suited to the plans, in the present instance 5 ft. In the end of the stick is a screw-eye that slips over the iron pin. These screw-eyes are separated by 2-in. ferrules cut from $\frac{3}{4}$-in. pipe. Finally, strings or wires, leading from a screw-eye near the top of the timber support, are fastened to screw-eyes placed about four inches from the end of the sticks on the rear side (*B*). Two blueprints, back to back, are then attached to the front side of the sticks (*A*) with drawing-pins.

Thus it will be seen that as each stick is swung back like the leaf of a book, two plans are disclosed. This is an advantage when the plans have a relation to one another as shown in the sketch.

AN American Petroleum Institute has been formed to promote co-operation between the industry and departmental or legislative organizations of the Government.

Production of Copper

By B. S. BUTLER

SMELTER PRODUCTION

The smelter production of primary copper in the United States during 1918 was 1,908,500,000 pounds, which, if compared with the production in 1917, 1,886,000,000 lb., shows an increase of 1.17%. The total value of the output in 1918, at an average price of 24.7 cents† per pound, is $471,408,000, against $514,911,000 for 1917.

In the following table the production is apportioned to the States in which the copper was mined. The figures

*Advanced statement issued by U. S. Geological Survey.

†The average price of 2,283,500,000 lb. of copper delivered in 1918, as reported to the U. S. Geological Survey by selling agencies, was 24.683c. per pound.

PRODUCTION OF COPPER IN THE UNITED STATES IN 1913, 1914, 1915, 1916, 1917, AND 1918

[Smelter output, in pounds fine]

	1913	1914	1915	1916	1917	1918
Alaska	23,423,070	24,985,847	70,695,286	113,823,064	84,759,086	67,081,648
Arizona	404,278,809	382,449,922	432,467,690	694,847,307	719,035,514	769,521,729
California	32,492,265	29,784,173	37,658,444	43,400,876	44,933,846	44,150,761
Colorado	9,052,104	7,316,066	7,272,178	9,536,193	10,054,951	7,591,570
Georgia				803,699	930,691	397,078
Idaho	8,711,490	5,875,205	6,217,728	7,248,794	6,446,224	5,836,795
Maine					34,872	501,169
Maryland		12,248	15,426	126,965	291,501	
Michigan	155,715,286	158,009,748	238,956,410	269,794,531	268,508,091	231,096,158
Missouri	576,204	53,519	306,406	377,575	407,141	232,073
Montana	285,719,918	236,805,845	268,263,040	352,139,768	276,225,977	326,426,761
Nevada	85,209,536	60,122,904	67,757,322	100,816,724	115,028,161	106,266,603
New Jersey				4,115		
New Mexico	50,196,881	64,204,703	62,817,234	79,863,439	107,593,615	96,559,580
North Carolina	180	19,712	33,383	5,961	125,004	79,200
Oregon	77,812	5,599	797,471	2,433,567	1,105,097	2,630,499
Pennsylvania	245,337	422,741		904	115,000	34,500
South Carolina					210,000	
Tennessee	19,489,654	18,661,112	18,205,308	14,556,278	16,093,757	15,053,568
Texas	39,008	34,272	38,971	86,463	2,061,129	13,851
Utah	148,057,450	160,589,660	175,177,695	232,335,950	227,840,447	230,964,908
Vermont	5,771		23,995	324,400	102,522	896,630
Virginia	46,961	17,753	50,008	1,066,143	146,912	1,248
Washington	732,742	683,602	903,661	2,473,481	2,051,416	2,330,568
Wyoming	362,235	17,082	351,871	1,784,351	2,019,767	866,698
Undistributed	51,385	65,479				
	1,224,484,098	1,150,137,192	1,388,009,527	1,927,850,548	1,886,120,721	1,908,533,595

PRIMARY AND SECONDARY COPPER PRODUCED BY REGULAR REFINING PLANTS AND IMPORTED IN 1913, 1914, 1915, 1916, 1917, AND 1918, IN POUNDS

	1913	1914	1915	1916	1917	1918
Primary:						
Domestic—						
Electrolytic	[a]1,022,497,601	[a] 991,573,073	[a]1,114,345,342	[a]1,579,620,513	[a]1,452,744,593	[a]1,560,327,422
Lake	155,715,286	158,009,748	[b] 236,757,062	269,794,531	268,508,091	231,096,158
Casting	22,606,040	21,506,325	21,555,129	12,469,050	69,916,911	15,284,635
Pig and best select	36,004,986	39,334,043	15,047,990	26,868,105	82,376,576	76,165,976
	[a]1,236,823,913	[a]1,210,423,189	[a]1,387,705,523	[a]1,888,752,199	[a]1,873,546,171	1,882,874,191
Foreign (electrolytic)	[a] 378,243,869	[a] 323,358,205	[a] 246,498,925	[a] 370,635,116	[ac] 555,000,000	[ac] 492,181,364
Foreign casting and best select						57,329,735
	1,615,067,782	1,533,781,394	1,634,204,448	2,259,387,315	2,428,546,171	2,432,385,290
Secondary:						
Electrolytic	14,862,577	27,702,928	38,156,789	78,585,296	66,337,771	34,674,062
Casting	22,360,182	4,224,052	21,417,901	25,838,511	12,779,125	9,018,049
	37,222,759	31,926,980	59,574,690	104,423,807	79,116,896	43,692,111
Total output	1,652,290,541	1,565,708,374	1,693,779,138	2,363,811,122	2,507,663,067	2,476,077,401

[a] The separation of refined copper into metal of domestic and foreign origin is only approximate, as an accurate separation at this stage of manufacture is not possible.

[b] Some Lake copper was refined at seaboard plants and doubtless marketed under some brand other than Lake. This has been excluded from the Lake copper.

[c] Includes refined copper imported.

represent the content of fine copper in the blister produced and the smelter output of ingot and anode copper from Michigan.

REFINED COPPER

The total production of new refined copper in 1918 was 2,432,000,000 lb., an increase of 4,000,000 lb. over that of 1917.

The reports from plants that treat secondary material exclusively are incomplete at this date. A statement of the secondary production will be published as soon as the figures are available.

In addition to their metallic copper the regular refining companies produced bluestone having a copper content of 7,917,696 pounds.

STOCKS

Returns from all producing companies show that their stocks of electrolytic, Lake, casting, and pig copper on hand at the beginning and end of the year were as follows:

STOCKS OF REFINED COPPER

	Pounds
January 1, 1919	180,000,000
January 1, 1918	114,000,000
Increase during 1918	66,000,000

In addition to the stocks of refined copper on hand January 1, 1919, 562,600,000 lb. of blister copper and material in process of refining were reported as at smelters in the United States, in transit from smelters to refiners, and at refineries, against 411,000,000 lb. on January 1, 1918. This does not include copper in stock at foreign smelters or in transit from foreign smelters to refineries in the United States.

CONSUMPTION

The apparent consumption of refined new copper in the United States in 1918 was 1,662,000,000 lb. In 1917 it was 1,316,000,000 lb. The method employed in determining the quantity of copper retained for domestic consumption is shown in the following table, which does not include stocks of copper held by consumers:

New Cornelia

The New Cornelia Copper Co. is constructing an experimental flotation plant which it expects to complete by the first of next September. This new addition is not being erected, however, for an immediate increase in copper production, but rather to give the company adequate facilities for the thorough experimentation of some of its semi-refractory ores. At present the company is operating all departments at about two-thirds capacity. It is keeping one eye on the copper metal market and one on the capacity gauge of the property. On 24 hours notice it can get back to full capacity. Indeed, it will be easier for New Cornelia to get into its full stride than for the deeper mines, as labor is not such a great factor in the operation. The company is preparing now to strip quite an extensive body of high-grade ore. This will be uncovered by steam-shovel instead of underground operation and at an obvious saving in time and expense. New Cornelia had its second birthday last month.

In June 1917 it made its first shipment of commercial ore and since that time has obtained an average extraction of 80% of the copper content of its ore. Without allowing for depreciation, depletion, or a reserve for excess profits taxes, the company is 'making' its copper today for approximately 13c. per pound. It has sold a substantial amount of its surplus metal, yet has held back enough to take advantage of the present market at 20c. Now that the metal market has begun to approach a level where something more than a new dollar for an old can be made, it is logical to expect New Cornelia to resume dividends on its 1,800,000 shares of stock. Last November it inaugurated payments with a distribution of 25c. per share. Right after, the copper market went into the doldrums and, of course, New Cornelia has paid nothing since. Of its total outstanding capital, Calumet & Arizona owns 1,200,000 shares, or 70%, and this latter company has been the guiding hand that has led New Cornelia so rapidly to success.

APPARENT DOMESTIC CONSUMPTION OF REFINED NEW COPPER IN 1913, 1914, 1915, 1916, 1917, AND 1918, IN POUNDS

	1913	1914	1915	1916	1917	1918
Total supply of new copper	1,615,067,782	1,533,781,394	1,634,204,448	2,259,387,315	2,428,546,171	2,432,385,290
Stock at beginning of year	105,497,683	90,385,402	173,640,501	82,429,666	128,000,000	114,000,000
Total available supply	1,720,565,465	1,634,166,796	1,807,844,949	2,341,816,981	2,556,546,171	2,546,385,290
Copper exported	[a] 817,911,424	[a] 840,080,922	[a] 681,917,955	[a] 784,006,486	[a] 1,126,875,368	[b] 704,715,714
Stocks at end of year	90,385,402	173,640,501	82,429,666	128,055,229	114,000,000	180,000,000
Total withdrawn from supply	908,296,826	1,013,721,423	764,347,621	912,061,715	1,240,875,368	884,715,714
Apparent consumption	812,268,639	620,445,373	1,043,497,328	1,429,755,266	1,315,670,803	1,661,969,576

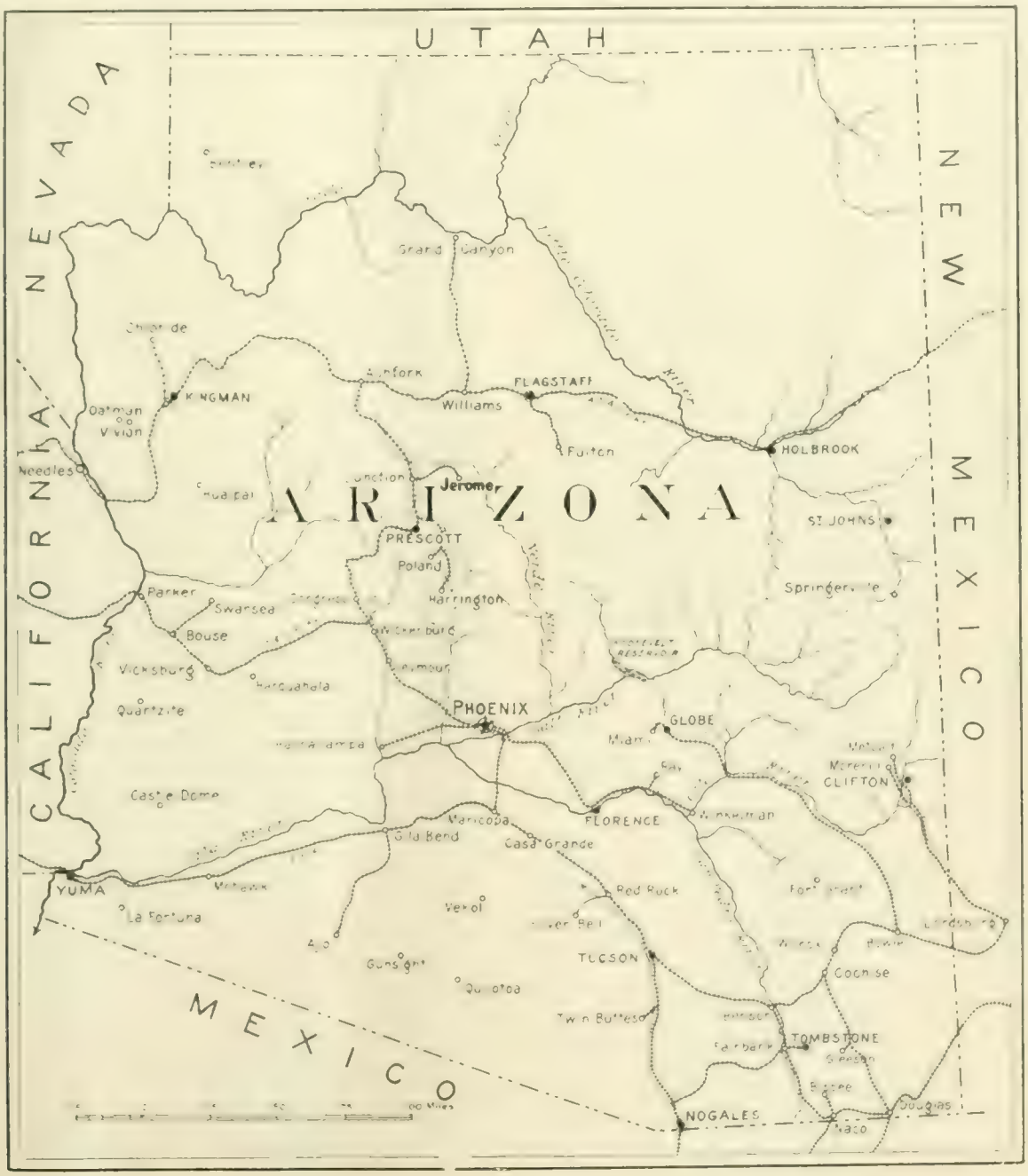
[a] Exports of pigs, ingots, bars, rods, etc., reported by the Bureau of Foreign and Domestic Commerce.
[b] Exclusive of manufactured copper.

REVIEW OF MINING

ARIZONA

COPPER QUEEN POWER-LINE. DENN ARIZONA MINE—SILVER VIRGIN DEVELOPMENTS.

BISBEE.—Plans for the construction of the Copper Queen concentrator near Warren, to handle the output of low-grade ore from Sacramento hill, are being worked out in detail by H. Kenyon Burch, and it is anticipated that the company will be in position to call for bids within the next 30 days. No details in connection with the mill have been made public yet. The power-line from the Copper Queen smelter in Douglas to the company's properties in the Warren district is one third completed and will be ready for operation about October 1. The



MAP OF ARIZONA

steel towers on which the power-transmission lines will be strung will form a direct line between Douglas and Bisbee. The towers are only about 100 yards from those carrying the Calumet & Arizona power-line, erected several years ago. The Copper Queen line will be supplementary to the power-plant at Bisbee, the increase in power being necessitated both by present large operations and increases planned for the future. The power-house of the Copper Queen smelter, in addition to supplying current for the operation of the big reduction works, supplies the city of Douglas and, by means of a power-transmission line 70 miles in length, drives the mine and mill machinery of the Lucky Tiger company at El Tigre, Sonora. Silver leases on the Copper Queen properties at Tombstone continue to be sought eagerly and there has been considerable increase in the number of lessees at work there within the last few weeks. This has given rise to reports that the company intended to resume work on its properties at Tombstone on a large scale, but this is denied. Only a small force is at work on company time, getting out low-grade ore used as a flux.

L. C. Shattuck, managing director of the Denn-Arizona mine, has announced a strike of more than usual importance on the 1700-ft. level. The extent of the orebody has not been fully determined, but at present more than 3000 tons has been blocked out. Assays show silver and gold in addition to the copper. Because of the increase in mineralization with depth, it is the intention of the company, after finishing the development of the 1700-ft. level, to drive on the 1800 to develop the extension of the orebody believed to be there. Larger pumps, however, will have to be installed before the plans for development below the 1700-ft. level can be carried through. At present the pumping equipment is handling 800 gallons per minute. The Denn mine came into the hands of the Shattuck-Arizona interests in 1906 and up to date more than $4,000,000 has been expended upon its development. During the war period it produced half a million pounds of blister copper monthly, but for several months it has made small shipments owing to concentration of the working force on development. This policy has proved effective in the development of the new orebody, which not only is important to the company, but also to the entire Warren district, by proving that the mineralized zone extended farther east than had been proved previously.

Douglas.—The Silver Virgin Mining Co., a Douglas corporation operating at Ajo, has opened an excellent orebody on the 100-ft. level, according to J. J. Adair, superintendent, who came here recently. He brought with him selected samples which run high in silver. The property is in the Quijotoa mountains 85 miles northwest of Tucson. The west drift on the 100-ft. level has broken into lime, and by cross-cutting it is expected to break into the orebody already developed by a drift extending southward from the shaft. Mr. Adair states there is 10,000 tons of ore proved carrying an average of $56 in silver at present market prices. The company was incorporated here a few months ago under the laws of Arizona with a capitalization of $150,000. The officers and directors are: A. B. Murchison, president; Joseph F. Deitrich, vice-president; S. W. White, secretary; Fred E. Cadwell, treasurer; J. J. Adair, superintendent; J. E. Shaw and H. D. Maynard. It is planned to construct a mill in the near future. An excellent road leads from Tucson through the Papago Indian reservation to the property.

COLORADO

GENERAL NEWS OF CRIPPLE CREEK AND LEADVILLE.

Cripple Creek. Stock transfer books of the Portland company closed July 12 preparatory to the payment of the regular quarterly dividend of 2 cents per share, which will amount to $60,000. The company is mining ore from two rich and strong shoots at the Roosevelt tunnel level, from the Lee 5 and Portland No. 2 veins. The depth is 2131 ft. from the surface. Net profits of the Cresson company for May, as shown in the July report of A. E. Carlton, the president, were $60,546. In concluding his monthly report Mr. Carlton stated "The labor supply, while somewhat improved, is not yet satisfactory and 63% of the production in May came from broken sources." Al Osberg and J. S. Christiansen have purchased the Tambourine group at Wall Street in the Boulder County mining district, one of the oldest and best known producers of that district. A contract has been made with the Golden Cycle Mining & Reduction Co. at Colorado Springs for the treatment of the Tambourine ores, and production is already well under way. The Anderson and Benkelman lease of the Trail mine of the United Gold Mines Co., one of the most profitable both to the operators and the owning company in the history of the district, has but four months to run, but it is estimated that although there remains 300 feet of crosscutting to tap the ore-shoot, the cost will be more than paid for in the first 30 days, thus leaving three months for profits even should no extension be secured. Anderson, Benkelman, Eby, and Orrison, partners in the lease, have all made fortunes from the ore sales, while the United Gold Mines Company has secured more than $110,000. The Beacon Gold Mines Co., H. M. Gilbert manager, continues shipping high-grade ore from its lease of the Index mine of the El Paso Extension Gold Mining Co. The leasing company is shipping about three cars per week and the ore is reported to average $40 per ton. The Rose Nicol mine on the north-west slope of Battle mountain, owned by the Rose Nicol Gold Mining Co., and operated under lease by the Reva Gold Mining Co., is shipping about 100 tons per week. The settlements are stated to be from $20 to $30 per ton. Two shoots are furnishing the ore, one on the eighth and the other on the ninth level of the main Rose Nicol shaft.

Leadville.—Stilwell Conner, a former successful Cripple Creek operator now leasing the properties of the Pearl Consolidated Mining Co., will soon commence shipping to the Leadville smelter. The Pearl Con. property is at Buffers, near Climax, in the strip in litigation be-

tween Lake, Park, and Summit counties, and has long lain idle. Mr. Conner determined to prospect a narrow vein of ore showing in the lower tunnel, which had been driven to cut the vein and shoot that produced heavily in the shallow shaft workings, but which had apparently missed the vein in depth. He followed this streak and it widened with every round, until he is now breaking seven feet of ore with the foot-wall only exposed. Samples are reported from 20 to 36 oz. silver per ton. Last week he visited Denver and made satisfactory arrangements with the Colorado & Southern Railroad for the reconstruction of the loading switch, which will enable him to ship at least a car per day to the Leadville plant. He has also sampled the old shaft dump and estimates there are 400 to 600 tons of ore available that will average 23 oz. silver or better per ton. This ore will be sorted and also shipped. The Bowman group in the Red Mountain district will soon be shipping to the Leadville plant. C. Harvey, the lessee, has opened up a strong vein by tunnel. The Wolftone in the same district has been reopened after long inactivity and is producing sulphides and carbonate of zinc. The company has contracted to deliver several thousand tons of the ore before the end of the year. J. H. Samm, operating a property owned by him on the south-western slope of Mt. Massive, has cut a strong vein of gold ore that is reported to average $6 per ton over a width of 10 ft. A trial shipment is to be treated to test the ore thoroughly and if results are satisfactory a cyanide plant will be constructed.

MICHIGAN

MINES HIRING UNDERGROUND MEN.—PRODUCTION FOR JUNE.

The operating mines in the Copper Country, including the Calumet & Hecla, Isle Royale, Quincy, Mohawk, Osceola, Ahmeek, Champion, Trimountain, Baltic, and Allouez, are adding underground men, principally miners and trammers, to their working forces, and it is expected that the total personnel will be increased 3000 men by the end of August. The first openings are being given to former employees, either underground or surface. It is quite generally understood, however, that this change of policy in employing men does not foreshadow any immediate increase in the production of copper, nor does it mean any increase in the number of surface men. The additional men will be put to opening new ground wherever possible. Calumet & Hecla and its subsidiaries do not intend to produce over 50% of normal, and it is not expected that the others will exceed 80% of normal for the present. The change of attitude on the part of the largest producers in the district reflects, however, the marked betterment in the outlook for the copper market, and has been received with pleasure throughout the district. The general belief seems to be that the situation has turned for the better, and that the turn is a permanent one for future prosperity. There has been a noticeable return of workmen to the district, but it will be some time before the returning men equal those who left during the slump in the copper market last winter and spring.

The production of ore from some of the principal mines during June is as follows: Champion, 36,000 tons; Baltic, 19,000; Trimountain, 15,500; Wolverine, 21,800; Mohawk, 44,000; Michigan, 5320; Mass Consolidated, 6082; Osceola Consolidated, 46,000; Ahmeek, 36,000; Centennial 4500; Allouez, 8700; Isle Royale 40,000.

NEVADA

GOLDFIELD, CARSON CITY, DENIO, INLAY, TUSCARORA

GOLDFIELD.—Ore sampling $15 to $22 per ton is showing across the entire face of the main drift and stope on the 200-ft. level workings of the Red Top mine of the Goldfield Consolidated, now operated by the Goldfield Development Co. A single blast recently shot down 3000 tons that sampled $67,200. At this point ore-reserves of 200,000 tons have been estimated to average $7 per ton. The management is planning to increase the capacity of the Consolidated mill to 2000 tons per day, and to place the plant in commission early in August at its present capacity of 1200 tons. Two ball-mills and other equipment will be sufficient to increase the tonnage to the desired point. The company is preparing to work extensively the north half of the Florence-Goldfield, recently taken under lease, and the mill for several months will operate principally on ore from the Red Top, Florence, and Mohawk. Meanwhile the cross-cut from the main drift on the 380-ft. level of the Combination mine is nearing its objective. With its completion arrangements will be made to work the 1,500,000 tons of low-grade ore in the Combination by the caving system. It is estimated 2,200,000 to 2,500,000 tons of ore is exposed, representing approximately $11,000,000 to $12,000,000. Late work in the Red Top and Mohawk proves the ore will run better than the average grade indicated. A. I. D'Arcy is manager and F. Dean Bradley mill superintendent.

CARSON CITY.—The vein recently opened on the Southwest Comstock, seven miles south-west of Virginia City, has widened to five feet of $50 silver-gold ore. It has been opened to a depth of 70 ft. and prospecting has shown that ore occurs on both sides of the walls. Copper has almost entirely disappeared and the gold content is steadily increasing. The ore is declared to be typical of that found on the Comstock Lode in surface workings. Arrangements are being made to increase the force and carry on development on a broader scale. Thurman Roberts is president and Walter Baldy secretary. Comstock Superior has started work on ground adjoining Southwest Comstock on the north-east. The formation is the same character as that occurring on the Southwest Comstock, and the owners expect to intersect the Roberts vein at shallow depth. Somewhat further toward Virginia City, ground has been acquired by the Eagle Comstock Co., in which Canadian people are interested. G. S. Clack, of Reno, is manager. Several groups of claims have been located since discovery of the Roberts vein, and preparations for much prospecting are being made by Reno and Carson City people.

DENIO.—D. C. Pomeroy reports discovery of a large deposit of gold ore in his Deegan & Cowden mine. At a

depth, or 50 ft. the vein was opened by a drift and stated to be of milling grade with the ore the full width of the drift. Construction of a small mill has begun.

INLAY.—Arthur Perkins and A. E. Springer have taken under lease and option the Santa Clara silver-gold group near Inlay. The property was a good producer when known as the Michigan Nevada. It is owned by Warren & Hawkins of Winnemucca.

TUSCARORA.—The Holden Mining & Milling Co. is erecting a 50-ton experimental mill on its property in this district. The plant will start work soon and a large mill is to be installed as soon as a suitable process for ore treatment has been determined. Developments are principally restricted at present to the Nevada Queen mine, formerly a large silver-gold yielder. C. C. Griggs is general manager. The Rose group has been purchased by F. L. Reber and associates of Winnemucca for $10,000 and a stock consideration. The property has been sufficiently worked to expose a strong vein of ore said to be of shipping grade. Extensive work is to start at once.

BRITISH COLUMBIA

NEW TREATMENT CHARGES AT THE TRAIL SMELTER.

Reference has been made to the dissatisfaction of the independent shippers of British Columbia with the treatment charges of the Canadian Consolidated Mining & Smelting Co. at its Trail smelter as set out in what is known as Schedule B. This, it will be recalled, led to an investigation by a special committee, whose report was issued a short time ago. The matter was discussed at the recent mining convention at Nelson, when it was announced by J. J. Warren, the company's general manager, that a new schedule was being prepared and would be issued shortly. That schedule now has been published and is effective. It provides the promised reduction in ore rates and more especially affects those ores containing zinc and sulphur. The schedule is as follows, the introductory table being the basis of payment for silver and lead:

	Silver payment, %	Lead payment, %
10% zinc or under	95	90
Over 10% and including 11%	94½	89
" 11 " " 12	94	88
" 12 " " 13	93½	87
" 13 " " 14	93	86
" 14 " " 15	92½	85
" 15 " " 16	92	84
" 16 " " 17	91½	83
" 17 " " 18	91	82
" 18 " " 19	90½	81
" 19 " " 20	90	80
" 20 " " 21	89½	79
" 21 " " 22	89	78
" 22 " " 23	88½	77
" 23 " " 24	88	76
" 24 " " 25	87½	75

Silver will be paid for on the fire-assay at the average of the quotations for the second calendar month succeeding the date of sampling at Tadnac, B. C. In no case will the deduction from the silver assay be less than one-half ounce per ton.

The lead contents will be determined by the wet method of analysis, deducting 1½ units to arrive at the dry lead assay. Lead will be accounted for on the dry lead assay to the extent shown by the above schedule; provided, however, that in no case will the deduction be less than one unit, or 20 pounds, per dry ton of ore. The price for lead to be used in settlement will be the sales price delivered at destination in Canada less 1½ cents per pound for refining and marketing as in effect under the existing pooling scheme, which will be continued. There will be deducted also, from the delivered sales price, $2.30 per ton on sales at Toronto and common points, $4.50 at Montreal and common points, and similar differentials to other points. This freight adjustment is to cover actual increases in freights; for example, should sales in any month be 2000 tons and, say, 1200 tons for delivery at Toronto and 800 tons at Montreal, the freight adjustment would be three-fifths at $2.30 and two-fifths at $4.50, or $3.18 per ton of lead.

The pooling scheme is outlined as follows:

(a) Settlement is based upon sales price as above provided and only to the extent of actual sales from month to month.

(b) Whenever sales are sufficient to settle for a full month's lead receipts this is done promptly.

(c) Lead from our own mines is pooled with that purchased from others and is treated in exactly the same way.

(d) Each month a statement is issued showing the condition of the pool. All shippers have been sent a copy of the last one issued.

The charge for smelting per dry ton of material is to be $9.50 as a base rate, which will be modified in accordance with the following formula:

1. Add to the base rate per ton, 60c. per unit for all zinc contained.

2. Deduct from this result the total units of silica, iron, manganese, lime, and magnesia at 9c. per unit.

Provided that in no case shall said base rate be reduced more than $4 per ton as the net result of the said additions and deductions.

Provided also, that in making the above computation, iron, silica, and lime if 1% or under, and manganese and magnesia if 3% or under, will be disregarded.

A charge will be made in addition to the above for all sulphur contained in excess of 2%, at 30c. per unit per dry ton of material, provided that such charge shall not exceed $3 per ton in any case.

A minimum moisture deduction of ½% will be made. The following penalty for moisture will apply to fine concentrates and clayey ore only. If over 5%, the charge for all moisture contents is to be 10c. per dry ton per unit.

Coarse and fine concentrates and ores should be shipped separately. If mixed so that over 30% will pass through a ¼-inch screen, an extra charge of 50c. per ton will be made. If the shipment is less than a car lot or contains more than one lot per car, a deduction may be made for extra sampling, assaying, etc., of $10 per lot.

ARIZONA

Bisbee.—The management of the Shattuck-Arizona Mining Co. reports that a strike of considerable importance has been made on the 1700-ft. level of the Denn mine. The size of the orebody has not yet been determined, but it is estimated that there are two or three hundred thousand tons of high-grade ore. The main shaft has been sunk to the 1800-ft. level, but the large volume of water encountered has delayed development.

Phoenix.—The Kay Copper company will build a 1000-ton concentrator at its mine in the Black canyon, about 50 miles from Phoenix. George W. Long is manager. F. A. Gillespie of Tulsa, Oklahoma, and his son, B. A. Gillespie, will build a large mill at their Red Rover mine, situated 50 miles north-west of here.

Tucson.—Silver-lead sulphide ore has been opened in the main tunnel of the Sunshine No. 1 claim of the Aguajito property of S. W. Purcell in the Papago mining district. This strike is 160 ft. below the surface. A bond and lease for $6000 has been taken on the old Dick Starr property six miles from Tucson, by Robert Hook and Mrs. Mary Hamshire. A 6-ft. vein of silver-lead sulphide ore has been opened up on the McKinley claim of the Banner group of mines in the Papago mining district. A Mexican has leased this property from Hereford and Hubbard, who are developing several properties in this district and operating a 15-ton mill.

CALIFORNIA

Nevada City.—Judge Jones of the Superior Court has handed down an opinion in the case of the Byron Jackson Iron Works of San Francisco against A. W. Hoge et al, recently tried here, and offers the suggestion that an amendment of the complaint is necessary in order that a value may be placed on each piece of machinery and with the same privilege to the defendants.

Nevada County.—G. H. Burnham, Deputy U. S. Marshal, has, in pursuance of an execution issued out of the United States District Court for the Northern District of California, levied on the personal property of the El Oro Mining Co. near Lake City. The proceedings are based on a judgment obtained by the Government because of non-compliance with the explosive storage law. The Government proved explosives had been stored at the mine without a license. The judgment is for $850, and if not enough personal property be paid to satisfy the claim the mine itself will be offered for sale.——A deed was placed on record last Friday whereby the large holdings of the Excelsior Water & Mining Co., owning land in Nevada, Yuba, and Placer counties, together with valuable water and mining interests, was transferred to the Interstate Land Holdings Co. The stamps make the consideration $120,000. It is understood that the control still remains in the Ayer family of Boston.——The Blue Point mine has resumed operations at Smartsville.

Lars R. Jorgensen, engineer for the Marysville-Nevada Water Co., organized to build a restraining dam on the Yuba for hydraulic tailings and to develop the nearby waters for power below Bullard's Bar, has five applications for water appropriations before the State Water Commission and has been allowed until September 1 next in which to file his map.

Plumas County.—The Standard Mining Co., operating two giants at the head of Nelson creek, near Johnsville, is preparing to raise its basket type of restraining dam to increase production next season.——The Feather River Gold Mines Co. intends starting immediately to reinforce and raise the dam on Jackson creek near Sloat. Its hydraulic operations were profitable this season.

Sierra County.—A cross-cut being driven in No. 6 tunnel of the old Sierra Buttes mine has encountered water, which is considered an indication that the vein is not far away. The present workings are 1500 ft. lower than a point where a good prospect was found some months ago, and renewed hopes are expressed that the cross-cut may intersect good ore.

Tuolumne.—The Carson Hill Gold Mining Co. earned net profits in June of over $61,000. This is virtually the first full month that the property has had an opportunity to test its earning capacity. From the beginning of operations in January of this year to the last of May it was concentrating operations on development and gold production was secondary. Yet for the first half of 1919 final net earnings totaled close to $250,000—and 70% of the ore treated was from development work. From 6843 tons of ore in June the company obtained an average extraction of $13.83 per ton. Recent months showed an extraction in excess of 92%. Including charges of all kinds operating expenses in June amounted to only $4.13 per ton. During the past three months, the company has cleaned off all debts incurred in its early construction with the exception of the $600,000 loan from the American Zinc Co. It will pay off $50,000 of this loan this month and by the fall the loan should be materially whittled down. Rapid strides are being made in the opening up of the Hill's newest level, the 875. A station has been completed at this depth, a cross-cut has been run to the vein and driving has been started. From primary operations this lowest level promises to be as rich or richer than the bonanza level above, the 675-ft. level, where for 140 ft. the ore averages $47 per ton. This confirms the statement made by the manager, William J. Loring, that the vein which showed such value in the levels above would continue on to at least the 875-ft. level, to say nothing of below.

IDAHO

Central Idaho.—An important strike is reported at the Center Star mine, near the mouth of the Crooked river on the south fork of the Clearwater. About five feet of gold ore is alleged to have been encountered in the face of the vein.

Kellogg.—The installation of milling machinery is proceeding steadily on the property of the Nabob Consolidated Mining Co. It is believed the work will be completed in August. Stopes have been opened and underground work is proceeding. The plant will have a daily capacity of 150 tons and has been designed to concentrate the ore developed in the Denver claim of the company and in the original Nabob group. Ore has been followed on two levels of the Denver for about 400 ft. on each. The ore is stated to average about 10% lead and 16% zinc.

Mullan.—The Federal Mining company will re-introduce the contract system at the Morning mine. The general labor situation is reported improved, with more men being added to the crews employed.

Wallace.—The new Ajax mill on Pine creek will begin operations shortly. A crew of about 50 men are employed at the mine, and enough ore has been blocked out to keep the mill in operation for some time.

MONTANA

Butte.—The local companies have announced that they will pay a scale of wages to miners, craftsmen, and salaried men at the rate prevailing during the War; the same to date from July 1. This is an increase of $1 per day for miners and craftsmen and 10% increase for salaried men, and is to be a flat rate not affected by the price of copper as heretofore. This rate to be effective is contingent upon the acceptance by the unions and is to hold for a period of one year.——An increase of $3,000,000 in the capital stock of the East Butte Copper Mining Co. is announced in papers filed, making the company's total $6,000,000. Oscar Rohn is manager for the company, which owns 114 acres in the Butte district, according to the statement. It gives the actual cash value of its property at $5,178,919.52.

Sildex.—Reports from the Amazon-Dixie mine indicate that the development which Wesley Everett, the manager, has under way is bringing the desired results. The showings in the drifts from the bottom of the shaft, both east and west, are reported as showing a marked improvement, galena being scattered all through the lode the full width of the drift.

NEW MEXICO

Carrizozo.—The Jacks Peak Tramway & Mining Co. of Dalhart, Texas, is preparing to develop its iron ore beds, situated 30 miles east of here. It is constructing a tramway 8 miles long, to give the mine a transportation outlet to the Chicago, Rock Island & Pacific railroad. The company has a contract to mine and ship 200 tons of ore per day. N. M. Vinyard is president and general manager.

UTAH

Bingham.—The Utah Consolidated has resumed work on its main shaft, which will be sunk to the 2000-ft. level. The lowest workings are at present 1000 ft. Work was begun on this shaft several months ago, but was discontinued owing to the demoralized condition of the copper market.

Park City.—Mining conditions in Park City are gradually coming back to normal, and it is thought that with reasonable assurance that a raise in wages will be granted, many miners will come back and every property will soon have its full quota of men. Petitions for increases in wages have been signed by the employees at each property and it is thought the raises will be granted. In the case of the Ontario, it is understood that the raise was agreed upon before the petition was circulated.

Tintic.—Articles of incorporation of the Tintic Prize Winner Mining Co. have been filed with the country clerk. Springville is named as the principal place of business. The company is capitalized for $100,000.

MEXICO

Sonora.—Flood water in the mountains between Esqueda, 35 miles south of here on the Nacozari railroad, and El Tigre, early in July, resulted in the washing out of the freighting road of the Lucky Tiger mine to such extent that the property was prevented for several weeks from reaching the railroad for shipment to the United States. The mine and concentrator kept in full operation, however, the concentrate and bullion being stored until the road opened again.

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

D. C. Jackling is at Juneau.

George H. Sexton is here from New York.

G. F. Laycock has gone to Atbasar, in Siberia.

F. R. Weeks is in Montana on examination work.

James F. Kemp is at Butte in connection with the Elm Orlu lawsuit.

B. C. Yates, superintendent of the Homestake, is taking a holiday in Colorado.

E. D. McDermott has been appointed manager of the Cape Copper Co.'s works in India.

James E. Chapman, who has been spending a few weeks in Wisconsin, has returned to Picher, Oklahoma.

John W. Mercer, who has been American Red Cross commissioner in Switzerland, is expected shortly in New York.

Thomas T. Read has been added to the staff of the U. S. Bureau of Mines and is charged with the investigation of welfare work.

George J. Young is now resident in San Francisco as the editorial representative of the 'Engineering & Mining Journal' of New York.

A. F. Brock has been promoted from head surveyor to the position of Mine Engineer to the International Nickel Co. at Copper Cliff, Ontario.

George H. Morgan, Major of Engineers, has returned from service in France. His present address is care of W. H. Weed, 29 Broadway, New York.

L. S. Cates, formerly general manager for the Ray Consolidated Copper Co., at Ray, Arizona, has joined the staff of the Utah Copper Co., at Salt Lake City, Utah.

Edward H. Robie, assistant metallurgist to the International Nickel Co. at Copper Cliff, Ontario, has joined the editorial staff of the 'Engineering & Mining Journal' at New York.

Alfred H. Brooks, Lieutenant-Colonel of Engineers and Chief Geologist to the A. E. F., has obtained his discharge from the Army and expects to start for Alaska from Washington at the end of the current month. He will visit Anchorage, Juneau, and probably Fairbanks.

William G. Sharp, president of the United States Smelting, Refining & Mining Co., died on July 1 at his home in Wenham, Massachusetts.

WAR MINERALS CLAIMS

The American Mining Congress makes public for the first time the grand totals of claims filed against the War Minerals Relief Appropriation as follows:

	Total of claims
Pyrites	$2,764,377.04
Manganese	7,946,155.59
Chrome	2,594,271.30
Tungsten	1,720,498.85
Total	$15,051,302.78

These totals will be analyzed for members later. No action has yet been taken by The American Mining Congress looking to corrected legislation to meet the published opinion of Attorney General Palmer which appears to eliminate a large part of the claims, but a meeting of manganese producers called in Congress headquarters for July 18 was expected to advise as to the desire of producers and a program will be announced later.

THE METAL MARKET

METAL PRICES

San Francisco, July 22

Aluminum dust, cents per pound	50—60
Antimony, cents per pound	8.50
Copper, electrolytic, cents per pound	23.50
Lead, pig, cents per pound	6.00—7.00
Platinum, ore, per ounce	$105
Platinum, 1oz., iridium 10% alloy	$121
Quicksilver, per flask of 75 lb.	$100
Spelter, cents per pound	9.50
Zinc dust, cents per pound	10.00—12.50

EASTERN METAL MARKET

(By wire from New York)

July 22.—Copper is active and higher. Lead is strong. Spelter is active and advancing.

SILVER

Below are given official or ticker quotations, in cents per ounce of silver 999 fine. From April 23, 1918, the United States government paid $1 per ounce for all silver purchased by it, fixing a maximum of $1.01½ on August 15, 1918, and will continue to pay $1 until the quantity specified under the Act is purchased, probably extending over several years. On May 5, 1919, all restrictions on the metal were removed, resulting in fluctuations. During the restricted period, the British government fixed the maximum price five times, the last being on March 25, 1919, on account of the low rate of sterling exchange, but removed all restrictions on May 10. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the normal rate of exchange.

Date	New York cents	London pence	Average week ending	Cents	Pence
July 16	106.00	54.12	June 10	109.43	53.27
17	104.50	54.25	" 17	111.98	54.48
18	103.25	54.25	" 24	111.52	54.40
19	105.50	Holiday	July 1	108.83	53.48
20 Sunday			" 8	107.52	53.47
21	106.12	54.25	" 15	106.35	53.38
22	103.75	54.37	" 22	104.85	54.25

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	75.14	88.72	101.12	July	78.92	99.62	....
Feb.	77.54	85.79	101.12	Aug.	85.40	100.31	....
Mch.	74.13	88.11	101.12	Sept.	100.73	101.12	....
Apr.	72.51	95.35	101.12	Oct.	87.38	101.12	....
May	74.61	99.50	107.23	Nov.	85.97	101.12	....
June	76.44	99.50	110.50	Dec.	85.97	101.12	....

Several factors are contributing to keep the market dull. Holders are firmly of the belief that present levels are only temporary; buyers seem to be equally convinced of the opposite view. It has been a dull season all around, and the heavy drop in sterlings has helped to keep the market inactive. Both in London and New York stocks have been moderate, and are more likely to be replenished than otherwise in the near future. For some reason or other, the demand from the European neutrals has not been as large as was expected. It was thought that they would at least buy in London; but so far they have taken very little. The China market has maintained its improvement, but there is no special strength at the moment. The tendency is toward improvement, if the exports are maintained. Indian currency returns show a progressive increase in notes with the reserve in silver, both in and out of India, practically unchanged.

COPPER

Prices of electrolytic in New York, in cents per pound.

Date		Average week ending	
July 16	21.75	June 10	16.81
17	22.00	" 17	17.58
18	22.25	" 24	17.89
19	22.50	July 1	18.37
20 Sunday		" 8	18.53
21	23.00	" 15	20.29
22	23.50	" 22	21.50

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	29.53	23.50	20.43	July	29.67	26.00	....
Feb.	34.57	23.50	17.34	Aug.	27.42	26.00	....
Mch.	36.00	23.50	15.05	Sept.	25.11	26.00	....
Apr.	33.16	23.50	15.23	Oct.	23.50	26.00	....
May	31.69	23.50	15.91	Nov.	23.50	26.00	....
June	32.57	23.50	17.53	Dec.	23.50	26.00	....

Copper has sold for September delivery at 21½c. per pound. Wire-mills have been the best buyers of copper, and wire quotations have been steadily advanced with the copper rise. Export copper takings hav been in good volume for European and Far Eastern account. One of the large selling agencies is rumored to have sold on July 14 almost 10,000,000 lb. for August and September delivery at 21¼ and 21½ cents.

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. Prices, in dollars per flask of 75 pounds:

Date		July	
June 24	95.00	" 8	100.00
July 1	95.00	" 15	100.00
		" 22	100.00

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	81.00	128.06	103.75	July	102.00	120.00	....
Feb.	126.25	118.00	90.00	Aug.	114.00	120.00	....
Mch.	113.75	112.00	72.80	Sept.	112.00	120.00	....
Apr.	114.50	115.00	73.12	Oct.	102.00	120.00	....
May	104.00	110.00	84.80	Nov.	102.50	120.00	....
June	85.50	112.00	94.40	Dec.	117.42	115.00	....

LEAD

Lead is quoted in cents per pound, New York delivery.

Date		Average week ending	
July 16	5.50	June 10	5.20
17	5.50	" 17	5.38
18	5.50	" 24	5.36
19	5.75	July 1	5.40
20 Sunday		" 8	5.40
21	5.75	" 15	5.42
22	5.75	" 22	5.62

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	7.64	6.85	5.60	July	10.93	8.03	....
Feb.	9.10	7.07	5.13	Aug.	10.75	8.05	....
Mch.	10.07	7.26	5.24	Sept.	9.07	8.05	....
Apr.	9.38	6.99	5.05	Oct.	6.97	8.05	....
May	10.29	6.88	5.04	Nov.	6.38	8.05	....
June	11.74	7.59	5.32	Dec.	6.49	6.90	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound:

Date		Average week ending	
July 16	8.00	June 10	6.58
17	8.10	" 17	6.88
18	8.15	" 24	7.02
19	8.20	July 1	7.36
20 Sunday		" 8	7.45
21	8.25	" 15	7.74
22	8.35	" 22	8.17

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	9.75	7.78	7.44	July	8.98	8.72	....
Feb.	10.45	7.97	6.71	Aug.	8.58	8.87	....
Mch.	10.78	7.67	6.53	Sept.	8.33	9.58	....
Apr.	10.20	7.04	6.49	Oct.	8.32	9.11	....
May	9.41	7.92	6.43	Nov.	7.76	8.75	....
June	9.03	7.92	6.91	Dec.	7.84	8.49	....

TIN

Prices in New York, in cents per pound:

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	44.10	85.13	71.50	July	62.60	93.00	....
Feb.	51.47	85.00	72.44	Aug.	62.53	91.33	....
Mch.	54.27	85.00	72.50	Sept.	61.54	80.40	....
Apr.	55.63	88.53	72.50	Oct.	62.24	78.82	....
May	63.21	100.01	72.50	Nov.	74.18	73.67	....
June	61.93	91.00	71.83	Dec.	85.00	71.52	....

FOREIGN EXCHANGE

The markets continue to decline and no relief is yet in sight. Sterlings, francs, and lire all touched new low points. As is usual at this season of the year, there is a flood of bills, and unless there is some special support the rates are not likely to improve. Fluctuations are violent, shifting so rapidly that quotations at any one time are almost nominal. There is little prospect of support for francs, with sterlings at present low levels. Even credits to France will not help, because the continental rate still seems to be regulated from London.

The lire market is mainly controlled by speculation, conditions in Italy being so bad as to take the rates down to any level. The rates may improve temporarily when the shorts begin to cover.

Quotations on July 22 are as follows:

Sterling:	Cable	4.31¾
	Demand	4.31
Francs:	Cable	7.11
	Demand	7.13
Lire:	Demand	8.60

Gold. The Treasury statement shows the stock of gold money and bullion held in the United States July 1 was $3,095,077,467, the highest point of the year. This is interesting in view of the fact that the combined statement of the Federal reserve banks as of July 3 showed a decrease in gold reserve since June 6, 1919, the Friday preceding removal of the gold embargo, of $72,900,000 due to withdrawals. Gold stock on July 1 showed an increase of $3,039,768 over June 1. As further bearing on the situation, the Federal Reserve Board said in its July bulletin: "Removal of the gold embargo has been followed by moderate shipments of gold, which, however, are much more than offset by gold either imported or shortly to be imported, and whose early arrival is certain. Foreign exchange has been in most cases weak and lower than during the preceding months, francs and lire being in a particularly unfavorable condition."

Eastern Metal Market

New York, July 16

All the markets are decidedly active except tin and prices are advancing, some rapidly.

Demand for copper is growing larger very rapidly and this is being reflected in successive price advances.

The tin market is still very quiet.

Demand for lead is better and quotations are higher.

The zinc market is becoming stronger each day on heavier demand, and prices are daily going higher.

Antimony demand is light and prices are unchanged.

IRON AND STEEL

Developments in the trade have been unusually favorable all the week and the indications are that activity will be sustained and perhaps cumulative the entire summer. The Carnegie Steel Co. is operating at 75 to 80% of capacity and a large independent interest at Pittsburgh is working at above 80%. At least a half dozen blast-furnaces are about to be blown in and the increase in bookings at rolling mills is calling for more pig-iron, the stocks of which have been steadily declining for more than a month. The June output of steel for the country is put at 2,640,984 gross tons or 105,639 tons per day as compared with 85,024 tons per day in May—a gain of 24%. Inquiry from all parts of the world is reported in export circles and no dullness is expected in this branch of industry. A Pittsburgh mill has booked 20,000 boxes of tin plate for Japan and much more is under negotiation.

COPPER

The prediction by Judge Gary of the U. S. Steel Corporation the last week in May that 20c. copper would rule in the near future has come true sooner than was expected only three or four weeks ago. The market is really advancing by leaps and bounds and higher prices are predicted. In the last week the market has advanced about 2c. per pound, 1.4 of this in the last day, electrolytic copper for July-August delivery being quoted at 21.75c., New York, with September not less than 22c., New York. Demand is heavy from many sources, domestic and foreign, and stocks are being rapidly depleted. Already the Government stocks of about 140,000,000 lb. have been sold and Japan has been a very heavy buyer, authoritative estimates placing that country's purchases at not less than 32,000,000 lb. in recent weeks and this buying continues. The labor situation is also likely to be an important factor in the future of the market. It is stated that only about 40% of the normal supply is now available in the West and much of this lack of labor will not be available again until after harvesting, while at the same time emigration to foreign countries is a serious item. One or two producers are now entirely out of the market for July-August delivery and are quoting not less than 22c. for September with no quotations beyond that. Lake copper is scarce for July-August delivery but is quoted at 22 to 22.50c. for this position.

TIN

Buying of tin during the last week has not been enough to talk about and therefore the market has been and still is very quiet. It is the only one of the markets that is actually inactive. There has been more demand for retail lots than for the wholesale and this has come from those interests, mostly small consumers, who did not take the allocated metal. There was some talk a few weeks ago that it would be financially advantageous for those holding allocated metal to sell it and buy future delivery. It has been said that as high as $300 per ton profit would be possible. It seems, however, that very few if any large consumers seem willing to take advantage of this possibility. The allocated metal in consumers' hands, which is available, is quoted at 70c. per lb., New York, for spot delivery with very little moving. Future shipment of Straits tin from the East is quoted at 51c. with Straits tin from England held at 52.25c. A stronger and higher market is predicted by some.

LEAD

The market is strong but quiet although from one or two sources a good demand is reported. The feature of the week has been the advance on Monday, July 14, by the American Smelting & Refining Co. of its price for early delivery from 5.40 to 5.50c., New York, or 5.15 to 5.25c., St. Louis. This advance has been expected for some little time and another in the near future would not come as a surprise. Some reports are to the effect that already business has been done in the outside market at 5.65c., New York. At any rate future lead has sold at $2 per ton over the prompt level, or at 5.60c., New York.

ZINC

The strength of the market is pronounced and prices have advanced steadily. The metal is even reported to be scarce. Almost daily in the last week quotations have advanced and buying by galvanizers and by brass makers has been heavy. Export demand has been no small item as has also the higher prices for ores. Prime Western for early or July-August delivery was today quoted at 7.70c., St. Louis, or 8.05c., New York, ushering in 8c. zinc. For September delivery 7.75 to 7.80c., St. Louis, is the asking price. Sellers are not forcing future delivery but are inclined to await developments.

A fair business is being done in high-grade zinc at about 8.50c., delivered. Sheet zinc is quoted at $10 per 100 pounds.

ANTIMONY

The market is quiet and dormant with quotations unchanged at 8.37½ to 8.50c., New York, duty paid.

ALUMINUM

No. 1 virgin metal, 98 to 99% pure, is quoted at 32 to 33c., New York, in wholesale lots for early delivery.

ORES

Tungsten: Chinese and Japanese ore has sold at about $7.25 per unit. A good demand for scheelite is reported; it is quoted at $10 to $12 per unit. There has been no test of the ferro-tungsten market and no reliable quotations are available.

Molybdenum: Quotations are nominal at 75 to 80c. per pound of MoS_2 in 90% concentrates with demand very light.

Manganese: Very little business is reported and actual values are hard to gauge. For the first time in nearly five years 714 tons of manganese ore from Russia was unloaded at Philadelphia last week.

Manganese-Iron Alloys: American producers of standard ferro-manganese have reduced their quotation to $115, delivered, more than meeting the British price of $115, seaboard. Very little business is reported. The spiegeleisen market is more active with sales of 1500 tons recorded and inquiries for substantial quantities. Quotations are about $35, furnace, for 18 to 22% alloy. Definite inquiries for this alloy from German-Austrian sources have appeared and some business has been done with other foreign countries.

SPEAKING of legal 'technicalities', as we do on another page, we are reminded of a story. An Irish attorney brought suit for a woman and failed to make his case, so that the Judge awarded a nonsuit. His client thought she had won and asked, "What of it, Judge Cooney?" for so the attorney was known to his friends. He replied, "We were about to win, Madam, but owing to a technicality of the law, the Judge decided against us."

CALIFORNIA'S Commissioner of Corporations, Mr. E. C. Bellows, has found it necessary to issue a warning to the investing public against offers of stock sent through the mails from outside the State, promising extravagant returns on so-called investments. Alluring pamphlets from oil companies operating in other States are being circulated freely among our people, usually without authority to offer such securities in this State and therefore in violation of the Corporate Securities Act, known commonly as the Blue Sky Law. The failure of such peddlers of get-rich-quick stocks is presumptive evidence against their good faith, for, if they complied with the law, they would have to undergo a full investigation of their assets and liabilities, methods of operation, prospects, and the reputation of their officials and agents—in short, the people of California would receive the protection that the Legislature intended to give by means of the Blue Sky Law.

LADY prospectors are frequently featured in the press of our mining communities. We note that one of them, no less than 70 years old, a veteran in the search for happiness if not for gold, has struck it rich near Marysville, itself named after some worthy pioneer of the gentler sex. This good lady found quartz assaying $200 per ton; and we hope there was at least a ton of it, but we are forced to doubt the favorable inference because the local chronicler says that "the pay-streak is only a few inches wide, but is free-milling ore." If it assays $200, it does not matter whether it be free-milling or refractory as a pack-mule. If women should emphasize the passing of the suffrage law by usurping the place of the male prospector we might expect a new style in the writing of reports. They might speak of a lacework of quartz seams or an insertion of calcite; if the lady prospector will but skirt the foot-hills she may find that the strata are pleated in lovely folds and that the limestone forms a ruching around the rhyolite; in her gentle hands the fairy tales of science and the long result of time will become so poetic that even the wild-catters will cease to speak of a precarious prospect as a 'manufacturing proposition', preferring to dub it a flirtation with the fickle goddess of Fortune, which would be more nearly true.

MATHIAS ERZBERGER, now Vice-Premier and Minister of Finance in the German government, made an important disclosure on July 25 when he quoted documents to show that Britain and France made overtures for peace in August 1917. The German government, through Dr. George Michaelis, the Chancellor, delayed its reply for a month and then gave a curt refusal to the proposal, although the Papal nuncio at Munich urged a conciliatory treatment of the attempt to terminate the great calamity. Herr Erzberger also referred to President Wilson's effort to bring about peace in 1916 and says that it was "sabotaged by the proclamation of unrestricted submarine warfare," instigated by the military party in Germany. In the light of these revelations, the drastic terms of the Treaty of Paris seem more than ever just; moreover, the disclosures of these earlier overtures on the part of the Allies should serve also to reconcile the German people to their misfortunes, which are logical.

UNDER 'Discussion' we publish a further contribution by Mr. H. R. Sleeman on the subject of 'Mill-tests v. Hand-Sampling'. Mr. Sleeman, it will be remembered, wrote a thoughtful letter, which appeared in our issue of March 29, discussing an earlier and most interesting article by Mr. Morton Webber on the same subject. In this article Mr. Webber advocated the determination of a series of sampling-factors by making a number of comparisons between hand-samples and bulk-samples, or 'mill-tests', from different parts of the mine under examination, and Mr. Sleeman, in his discussion, among other things pointed out the difficulty of obtaining sufficient hand-samples for each comparison, and the consequent danger of the average of the sampling-factors being erroneous. Mr. Webber took issue with this, contending that Mr. Sleeman had misunderstood his article, and it is in reply to Mr. Webber's letter that Mr. Sleeman now writes. He brings out the point that the bulk-samples should be taken according to the distribution of the ore-shoots, and not according to any system of equal measurements; but stands by his contention that many

comparisons would give such divergent results as to discredit them without further sampling. From our own experience we may state that discrepancies between hand and bulk samples consistently within the limits of 8% and 10%, such as Mr. Sleeman considers desirable for the safe application of the method, could occur only when the mineral distribution was of such uniformity as rarely comes within the experience of the profession.

PROMOTERS and reporters play the very devil with geology. For instance, we read in one of our local papers that the president of a mining company at Tonopah "reports everything in tip-top condition." No wonder, for "at present they are in a formation of anthracite and porphyry, which is the true formation to make ore in the Tonopah district." We hasten to the help of a bewildered reader by suggesting the substitution of 'andesite' for 'anthracite'; but even that will not suffice to make sense, because the andesite is a 'porphyry', that is, an igneous rock in which some mineral is so prominent structurally as to give it a speckled appearance. In this same Nevadan prospect we are told that "they will soon cross-cut on the 200 and then some real developments are bound to be found." This is an excellent example of journalese, using the abstract instead of the concrete; we hope they will find some real ore, that is, 'pay-ore', instead of anything so indefinite as 'developments'. One can find them without incurring the cost of mining.

OUR excellent contemporary 'The Commercial and Financial Chronicle', of New York, publishes statistics of gold and silver production in its latest issue. It gives 160,879,206 ounces as the world's output of silver in 1918, as against our estimate, published on June 7, of 177,453,309 ounces. The difference is mainly in the Australian figures, as to which the 'Chronicle' is wrong. Our Mexican estimate is also considerably larger, but as to that we are less confident. The world's gold production is not given by the 'Chronicle', owing to the lack of statistics for countries other than the United States and the British dominions, but we note that Russia's output is estimated at $17,157,594, as against our estimate of $10,000,000, it being our opinion that the political disorder in Siberia crippled mining in 1918 more than apparently our contemporary is inclined to believe. In all such estimates of world production, the statistician is faced annually by the lack of accurate data from any but the English-speaking countries. Another trouble has been made for the statisticians by the fall in dollar-pound exchange; the 'Chronicle' uses $4.8665 as its equivalent for the pound sterling, but that ratio has become academic.

YGNACIO BONILLAS, the Mexican ambassador to the United States, has found it convenient to explain that Mexico has a stable government and that if parts of the country are subject to bandits it is but the aftermath of civil war, just as parts of the United States were in a condition of disorder after our own unpleasantness. He likens Villa and Zapata to Jesse James and Geronimo, and bespeaks co-operation in the pursuit of such bandits across the international line. This spoof he follows with an assertion that "foreigners in Mexico are afforded every protection," in calm defiance of evidence, continually accumulating, to the contrary. He insists that Carranza's troops are "ever on the heels of these bandits"; but the trouble is that they fail to overtake them and when they do they either shoot into the air or sell their guns to the gentlemen with heels. Perhaps Señor Bonillas will be better understood when we note the fact that he is to become a candidate for the presidency of Mexico. Meanwhile American sentiment on the treatment of our nationals in Mexico is developing, even to the point of a suggestion made in Congress, and applauded, that American troops be sent into Mexico to give the protection the government of that country is unable to provide for the lives and industry of peaceable citizens.

AMONG recent prospectuses we note that of the Rominco Mines Company, organized to operate the Big Four group of claims in the Gowganda district of Ontario. We are informed that these prospects are "within a short distance (just about a mile) of the famous Miller Lake O'Brien mine," but this does not mean much to us because we know that a bonanza is often within stone's throw of a borrasca, in short, richness may abut upon poverty in rocks as in life. Indeed, the fact that a number of famous mines are situated within "a radius of five miles" of the Big Four property would not unloosen our purse-strings if we were inclined to speculate in the stock of the latter. We would ask for more pertinent proof of our chances to become rich thereby. "For those who would grow independent," says the prospectus, "the time for investment is when the great producers are still in the development stage." We agree to that, although we would say that for the speculator in mines the promising prospect affords the best chance of making money; but more than conversation is needed to indicate that the prospect is one of promise. "Canadian silver mines are today making fortunes for hundreds of people." This is true, as it has been during the last fifteen years, but there are thousands of people who have lost money in such enterprises and the wise man will seek for evidence to assure him that he will be counted among the few, not numbered among the many. Such evidence the Rominco prospectus fails to give. "Every geographical indication says that the Big Four mine will be no exception to the rule" of enriching its stockholders. Geographical or botanical or entomological indications are insufficiently convincing; we want to see testimony as to facts and an opinion as to results from a competent engineer, that is, one experienced in this kind of mining in this region. "Mining has scored less than 35% of failures, as against 95% of failures shown in the general merchandising business of the United States." This is not true. Take the number of claims located in any important mining region and find out how many locations

even went to patent, then count the number of claims patented and find out how many of them became profitable mines. Mining is not less risky than other forms of human enterprise, but it is, we believe, more profitable if properly conducted. The proportion of mining ventures intelligently managed is relatively small, so that the number of failures is proportionately large. We hope that the promoters of Rominco, or Big Four, will take warning from the experience written large on the records of mining. "A mine contains a crop already raised, harvested, and on deposit in the bank for you to check against at your pleasure," says this prospectus. A mine may be likened to a crop that exists amid a mass of weeds, sometimes in a swamp that must be pumped dry, usually so situated that the harvesting requires the maximum of skill in order to obtain a product that is marketable. It is a crop that once garnered cannot be renewed; there is no rotation of crops in a mine; it is a wasting asset; and the pleasure of checking against it is dependent upon scientific effort and intelligent labor such as the ordinary writer of prospectuses cannot appreciate and cannot himself contribute.

Editorial Independence

In order to correct the aberrancies of such journals of opinion as 'The Nation' and 'The New Republic', a rival called 'The Review' has been started in New York by a group of gentlemen calling themselves Constitutional Republicans. We fear that the new periodical will not be sufficiently voluminous to correct all the errors of its two principal rivals, but it has started on its career under good auspices in one respect at least. We note that the act of incorporation contains the following provision: "In the conduct of the said journal and its editorial policies, the Editors shall not be responsible or accountable to the Corporation for any opinion, comment, or criticism lawfully made or expressed by them." If this proviso is faithfully observed, the 'Review' should prosper, it being assumed that Messrs. Fabian Franklin and H. de Wolf Fuller, the editors, will prove judicious and effective writers. It is gratifying to note in these days that editorial independence from the business department is recognized as an essential feature of self-respecting, and respected, journalism. We do not include the Hearst gutter-press or other similar manifestations of newspaper prostitution. As regards the trade and technical press—or 'class' journals as they are more properly called—it is pleasant to record the fact that the independence of the editorial department is generally recognized, because, fortunately, the syndicated groups controlling most of, but not all, these periodical papers are devoted neither to political nor other propagandist purposes, but to the straightforward making of money out of the business of publicity, and therefore they leave the editorial policy to the proper persons, having discovered this to be the more excellent way. In this respect they are more fortunate than many daily newspapers. Further, the technical mining papers of this country, namely, the one in New York and the one in San Francisco, escape the menace to their integrity presented in England—and that means London in this context—by the 'company meeting'. When a British mining or metallurgical company holds an annual or other public meeting, the record of the proceedings is sent to the press, and payment is made for publication at rates equal to those charged for ordinary advertisements. It is the usual practice to print the report of a company meeting in the reading matter, so that the public hardly realizes that it is paid stuff; the 'Mining Magazine' was the first mining paper in London to place the company meetings on its advertising pages, thereby making it evident to what category they belonged. Now, these company meetings are an important source of revenue to the financial and to the mining press, but they serve as a sop to Cerberus in some cases and as a means of unblushing bribery in others; by aid of them the financial world of London is victimized by some sixty samples of predatory journalism. It is obvious what a chance is afforded the big mining interests to patronize or to discipline the mining papers according as they are kind in their comment or severe in their criticism of the doings of the directors, promoters, and engineers connected with the various enterprises whose offices are in the City. This opportunity to exercise a sinister influence upon the editorial policy of the three mining papers in London is used even when, as in the case of the 'Mining Magazine', the company meetings are relegated to the advertising pages. If the editor offers vigorous criticism of anything done improperly by the chairman or directors of a mining company, he may expect to be told by his associate in the business department that he has been notified that the report of the next company meeting will be withheld, which means that the sop will be given to other papers, but not to his. To be frank, the publication of the report of the company meeting has only a slight news value, because it will have appeared—at the customary cost—in the daily financial press before it can be read in any weekly or monthly periodical, and it also has only a small value for publicity, by making known the mining company and thereby helping the market for its stock; it exists chiefly as a source of revenue to the press and a means of persuasion to the financiers; in short, it is baneful. In time the proprietor of a real technical periodical discovers that although the sacrifice of his opportunity to exercise his function as a critic may augment the number of company-meeting advertisements it will repel the kind of reader he desires, namely, the engineers, consultants, and managers of mines, and concurrently the business department will lose the kind of effective subscriber that it finds necessary in fulfilling the purpose of its publishing activities, which is to furnish a medium of publicity for those selling the supplies and machinery used in mining operations. Shareholders, directors, and the like are dead wood to the manufacturer, because they do not buy, nor do they even select, the things advertised in a mining paper; therefore they are ineffective subscribers or readers. The American

mining paper, while claiming no particular virtue, misses this source of revenue and likewise escapes this means of corruption; the big mining and smelting interests can exercise no such covert influence, and the character of our papers is fortified thereby. The only direct menace to the freedom of the technical press would be the purchase of a paper by one of the big mining or smelting combinations, and of this there has been no sign whatever at any time or in any place. The mining public would resent it too quickly to render it practicable. A periodical, called 'Mines and Methods', was published for a few years at Salt Lake City in order to wage a vendetta on the part of one mine operator against another, but it failed, as it deserved, because it had no legitimate reason for existing, despite the printing of an occasional technical article of some value. The metal dealers are almost the only advertisers with whom the editor comes into necessary contact, in the course of his duty to give his readers well-informed comment on current events, but they constitute a very minor part of the clientele of the 'Mining and Scientific Press', largely because the metal markets centre at New York, so that our comments on such matters also can be made without incurring the sorrowful rebuke of our business department. Indeed, an editor can feel grateful for such freedom of his pen as comes from the fact that he is called upon to write on matters that do not affect the pocket nerve of his advertising supporters. Such detachment—not degenerating, however, into vacuous aloofness—is the best guarantee of reasonable independence; absolutely independent no human being can be, for every man has prejudices and preoccupations that color his views of life; but we confess that the editorial ideal, expressed though it may be with some lack of literary refinement, is the truly American notion of living so as to be able to look any man in the face and tell him to go to hell, most politely, most politely.

War Minerals Relief

The Commission created under the War Minerals Relief Act has finished its session in San Francisco and is now at Medford, Oregon, where a large number of claims are being presented for adjudication. In our issue of July 19 we expressed a not unreasonable feeling of indignation against the ruling of the Attorney-General in regard to awards under the Act, our opinion being that this narrow interpretation was entirely out of harmony with the spirit of the enactment and if accepted in the decisions of the Commission it would do serious injustice. The fact is that under the Attorney-General's ruling the ones most likely to receive compensation are those who delayed in one way or another to produce the needed minerals until specifically requested to do so by an agent of the Government. Those most patriotically inclined responded to the earliest suggestion of the Government, as to the production of chrome, manganese, tungsten, and pyrite, for they acted on the suggestion when it was first conveyed to the mining public by means of the press. These men did not wait for a specific request from a Federal official assuring them definitely that the price of the mineral would be fixed or some guarantee made against loss; they went to work on the first promptings of duty to the Nation and if they saw a chance of making some money honorably while discharging that duty they are still deserving of a practical form of gratitude for the service they performed at a time of acute crisis. Here we may advert to the fact that during the sittings of the Commission in San Francisco, it has happened often that a claimant for compensation has been asked whether he produced, or set to work to produce, the war minerals for a patriotic purpose only or whether the expectation of gain had motivated him; to this the witness has usually replied by acknowledging the pull of family obligations and the like; whereupon he has been asked to state the proportions of patriotism and self-interest respectively that had moved him into productive action. We submit that this is not fair, because it is given to few men to appraise accurately the multiple motives that induce them to perform certain actions, good or bad, and that the most conscientious man is the one bound to suffer most before the Commission when undergoing such a catechism. Psychologically it is a defective way of getting at the truth. If a man comes forward to serve the nation, we do not ask him whether he is moved to do so in order to win the esteem of his fellows, to do work that he likes, to salve his conscience, or to please his mother. The one fact that should weigh is his willing performance of the service. In considering the sufficiency of published articles as constituting encouragement or invitation by the Government to produce war minerals, it should be borne in mind that the Government generally was unable to resort to personal solicitation in its various food-saving and other war-time measures; instead it conducted a nation-wide propaganda by means of the press, knowing that the people depended upon their newspapers, periodicals, and class journals to keep them informed as to the things they could do in the furtherance of the national purpose. The publication of a dispatch from Washington to the effect that certain things should, or should not, be done was generally regarded by the good citizen as a personal order or request. There is also the fact that on March 17, 1918, the California Chrome Company issued an advertisement urging the production of chrome, and this was done with the full knowledge of, if not instigated by, the Ferro-Alloys Section of the War Industries Board. Furthermore the price of 80 cents per unit then established was rendered possible only on the basis of an understanding with the Government. It was under these conditions that the statements in regard to the country's need of certain minerals by Secretary Lane, Mr. Van H. Manning, Mr. George Otis Smith, and other officials at Washington were read and acted upon. To ignore these facts is wrong; it is entirely contrary to the observance of that good faith which must be implicit in any official utterance and action.

DISCUSSION

Mill-Tests v. Hand-Sampling

The Editor:

Sir—My copy of your issue of March 29 has been delayed and has only just reached me. I have read Mr. Morton Webber's structure on my comments concerning the method of checking hand-sampling described by him in your issue of September 29, 1917.

I regret that Mr. Webber should be personal. If I misread his words, assuredly that does not infer that I deliberately distorted them. Obviously I had no possible object in wantonly misreading or distorting it. In re-reading my letter it does not seem to me to appear unmodest or offensive. Indeed my intent was only to discuss a certain part of his contribution, not to criticize.

I have re-read Mr. Webber's article and I find that I did misunderstand him as to the matter of the number of hand samples accompanying each bulk sample. I think I inferred smaller areas, and therefore smaller individual bulk samples, and a larger number of them than he meant. No doubt the big discrepancies he supposed between the different comparisons of results of mill-tests and of hand-sampling led largely to my mistake. A sampling error of 25% would be enormous and to me suggested that the sampling of the ore comprising each individual mill-test could not comprise a sufficient number of samples to bring properly into play the law of averages.

Subject to the bulk samples being sufficiently big and to the number of hand samples accompanying them being sufficiently large, I quite see the value of Mr. Webber's method and appreciate his publishing details concerning it. I must confess, however, that were I to obtain a difference of up to 25% between results from bulk and hand sampling of a particular place, I should not be satisfied, without further sampling and investigation, to accept such a difference for the purpose of applying the idea of a sampling-error over a considerable area or tonnage. Reading Mr. Webber's later comments, I think that, apart from the above, the one point on which we may differ is with regard to the selection of the localities for the bulk samples.

I infer from Mr. Webber's letter that his method of subdividing the deposit into areas, each one of which has its mill-test, is mainly into rectangular areas of more or less equal dimensions, but arranging and modifying these as rendered desirable by the varying nature of the ore. His diagrams give me that impression. Whether my inference is correct or otherwise the point seems worth elaboration.

It appears to me that primarily the location of the bulk samples should depend on the distribution of the various types of ore. The most usual variation with which we have to deal in any one deposit is that of change from ore in varying stages of secondary alteration to unaltered primary ore, and this variation would occur mainly vertically, though by no means wholly so. I submit that a logical basis of applying the idea of sampling-errors based on bulk tests would be to first map as closely as possible the outlines of areas consisting of the different classes of ore into which it appears best to classify the deposit, the locality of each bulk sample being then selected with regard to such outlines. With regard to the numbers of bulk samples to be taken for each class of ore, that I submit might largely depend upon the sampling-error indicated as the results of bulk-tests and of hand-sampling were obtained and compared. If such results indicated approximately similar differences between bulk and hand sampling, then a very few bulk samples should suffice. If, on the other hand, the results gave widely varying differences between bulk and hand sampling, then more comparisons (that is, more bulk samples) would be needed.

Thus, supposing for one class of ore, two or three such comparisons gave a similar difference (say, varying from 8 to 10%), it is fair to assume that those comparisons could safely be used for the purpose of establishing sampling-errors, or alternatively one average sampling-error, for the whole of that class of ore, whether in one area or not. On the other hand, if the results of the first three comparisons varied, say, from 5 to 15%, it would appear unsafe to stop at that number of comparisons. Sampling-errors based on such comparisons, whether applied separately or on the basis of average to all that class of ore, would, it seems to me, be unsatisfying. In such cases I submit that more comparisons (more bulk samples) would be required, either to indicate the reasons for such variation—which reasons might greatly help in finding what allowances to make—or to bring the law of averages sufficiently into operation. Speaking generally, it seems to me that sample-errors would better be obtained and applied as to different classes of ore rather than as to different areas.

It might be that different types of ore (that is, types of ore that might give different sampling-errors) occur so distributed that the dividing of the different types by means of areas would not be feasible. In such cases the logical method seems to be to hand-sample the different types separately and to secure sampling-errors (by means of bulk samples) for each type. The tonnage of

each type would then have to be estimated as closely as conditions permitted and the corresponding sampling-errors applied to the different tonnages. It is impossible within modest length to do more than outline ideas and the above must of course be read as not attempting to particularize.

With regard to Mr. Webber's further comments; these in no wise controvert what my letter stated. One cannot provide against every possible misreading of one's words without running to unwarranted length. My letter was meant to indicate (and seems to me clearly to do so) that latent errors in sampling exist, apart from 'sloughing' or 'horses'. But for this admission, the checking of hand-sampling by bulk tests would obviously be superfluous. I say, "it seems to me that mill-tests may be a most useful check on results obtained in (1) and (2), more particularly in some deposits (obviously those whose nature renders them more open to errors in sampling)"; again, "I believe that bulk-sampling can be used in most, if not all, cases with advantage as a check on the small samples and probably its use may enable factors of error to be obtained that can be applied to the whole of the small samples." I would add here that where bulk tests cannot be made, the engineer must just rely on his experience and observations to judge what allowances he should make for the sampling-error in each case.

My reference to the comparison of sampling results with the results of actual operations, either in the same mine or in neighboring mines, includes allowance for sampling-errors. Truly such comparisons include also decrease in grade due to 'sloughing', 'horses', etc., and these sources of error cannot by such comparisons be proportioned. They give only comparisons between sampling results as a whole and actual working results as a whole, both as regards grade and tonnage, but do not indicate how much of the difference in grade is due to sampling-error and how much to inclusion of country-rock. If one had the means of estimating the proportion of country that has got into the ore treated, he might from that deduce the approximate sample-error.

In closing, I would mention that I asked a question in my letter. It was whether, in the event of a bulk sample giving higher results than its accompanying hand-sampling, would Mr. Webber apply the factor so obtained by increasing proportionately the results of hand-sampling within the area concerned. In everyone of his comparisons the hand-sampling gives higher results. There would sometimes, if infrequently, be cases of it giving lower results.

H. R. Sleeman.

Perth, Western Australia, June 4.

Patent Controversies

The Editor:

Sir—The writer read with interest in your issue of June 21 your discussion of the Supreme Court's decision in the Minerals Separation controversy. In your editorial discussion of the decision you state, "The entire controversy proves once again how undesirable it is to leave the decision of technical and scientific questions to courts composed of men without a special training for the understanding of such questions." Your conclusion is so sound and basic—striking at the root of many of our legislative and judicious tangles—that I could not resist the impulse to write to you and tell you so. In our legislative panaceas we assume the probity of purpose actuating the average individual as to his desire to reach a morally correct conclusion on any given question, but in providing the legal machinery for carrying these panaceas into effect we apparently assume that mere probity of purpose is a sufficient qualification for a jurist or a legislator to solve any given question under the sun. We are possibly approaching an era when tribunals, legislative and judicial, will be organized along trade or technical lines and to which will be referred the questions particularly falling within the scope of the educational qualifications and experience of each with mixed or general tribunals confining their activities to questions or principles of human relationship in which the issues do not involve points that require technical understanding. The two forms of issues mentioned, while frequently having a distinct line of cleavage, will as frequently interlock, but in such cases we can trust that technically equipped minds do not necessarily lose their probity or balance of judgment by reason of being so equipped. A short book by Steinmetz analyzes this problem in an engaging and convincing manner.

C. W. Mason.

Juneau, Alaska, July 2.

The Status of Gold

The Editor:

Sir—In your issue of March 22 there appeared a letter from me presenting an argument that the value of gold is greater today than at the time when the weight of the British sovereign was fixed, and in your issue of May 17 I replied to certain criticisms on the first letter.

In these letters I plainly pointed out that governments cannot fix the value of gold, they can only recognize the values placed upon the metal by humanity; the value placed upon gold by humanity has increased since 1812 and the fact must be recognized; the "maintenance" of the present price of gold and the failure to "adjust" that price to the true present value will incite hoarding, will increase labor troubles, and will increase the gravity of the present financial situation of the world.

Nowhere in what I have written is there a basis for the criticism that "Mr. Robbins appears to be obsessed by the idea that a government by legislative action can infuse more labor-energy value into labor-energy value already existing in the form of gold." My contention is that governments must by legislation recognize the true labor-energy value that already exists in the form of gold; the infusion of labor energy-value into gold has already taken place, and the fact must be recognized. No critic has shown that the labor equivalent of gold has not increased during the past one hundred years, nor that governments cannot recognize a new value in gold.

In spite of the statements made to the contrary, I maintain that to increase the price of gold will not only lead to an increased output of that metal from mines, but will bring into circulation a vast amount of hoarded gold. In the reduced hours of work, increased wages, and higher standards of living, in Australia, South Africa, Canada, and the United States, I find what seems to be irrefutable evidence in support of my contention. The stupendous development of Western United States, Australia, and South Africa received its impetus from the discovery and production of gold; and all of this development has taken place since the price of gold was fixed. Every ounce of gold has stored in it some labor-energy value not only of the miner, but of the prospector, the railway-builder, the ship-builder, the road-builder—in fact, of every man, woman, or child who has contributed mental or physical labor toward building up civilization, for gold is the exchange commodity for settling balances in the world's exchange of labor.

Attention has been drawn to the fact that the present high cost of living synchronizes with the recent increased production of gold, but it also synchronizes with the wonderful growth of scientific achievements; measured by benefits demanded, it is probable that the cost of living would have increased regardless of increased gold production, for the production of large quantities of gold has facilitated, it did not cause, expansion.

Life today embraces the use of automobiles, electric lights, and thermos-bottles; these things are rights of heritage, and the benefits that now accrue to the few are rapidly entering into the life of all. The advance of civilization may be checked only by stopping education and by making it a capital crime for any brain to have an original thought, for any man to originate an improved method, for any inventor to discover a way of making life more enjoyable. Facilities of communication, methods of transportation, manufacturing organization, and selling propaganda have placed humanity in possession of countless refinements—refinements that have ceased to be luxuries, having become necessary to satisfy the knowledge of life's possibilities, and not only have people learned of the things they may have, but they have found means for getting those things. The business of the world has expanded enormously and the wage of today brings to its earner a greater number of benefits than did the wage of years past.

Now, all of this increase in wealth, in business, is based upon promises to pay. Stocks, bonds, insurance policies, mortgages, and notes are the securities of wealth and back of all such instruments is the reserve stock of gold. But this reserve stock of gold has not increased in bulk at the same rate which has marked the increase of government, corporation, and commercial securities, and hence the potential influence of an ounce of gold has of necessity increased. The activities of humanity have infused into the reserve stocks of gold a greater labor-energy value than those stocks possessed one hundred years ago.

Our financial securities are pyramided upon a base of gold, and always the further we get from the gold reserve the more speculative become the securities dealt in. Remove all gold from commercial use and a panic will ensue; the highest class of securities will be dealt in, and these will be hoarded, thereby adding to the difficulties of the situation. Give gold a price of $10 per ounce and there will be a scramble to secure it for hoarding, paper securities being 'thrown overboard' and sacrificed for gold.

In the panic of 1907 instant relief was produced by the action of Morgan and Rockefeller in releasing from their private vaults forty million dollars of gold for the use of Wall Street. The present price of gold being $20 per ounce and the present value of gold being $30 per ounce means that gold is bound to be hoarded. Any expansion of business that tends to lessen the value of $30 per ounce is met by a withdrawal of gold from circulation, which action decreases business and reacts to hold the labor equivalent of gold at $30 per ounce by producing hard times.

The policy of the Bank of England has been to manipulate gold reserves so as to force the world to discount exchanges in London. I was in England in the spring of 1914, and however proud Britain may have been of her cloak of foreign trade, it ill concealed the poverty in her industrial centres.

At the present time the United States holds over two-thirds of the world's available gold supply and if our foreign debtors were called upon to settle balances in gold we should have all the gold in the world. The endeavor of European powers will be to get our gold away from us. Probably the easiest way will be for them to send their workers over here to get the gold; to work in this country at high wages, and send their savings to the home country. Every endeavor will be made to do this and we shall benefit by increasing the activities within our boundaries. But if we allow these savings to be exported at the rate of $30 value for each $20 of savings we shall become the centre of a maelstrom of obnoxious endeavor. The effort will not be to maintain sane conditions, but to foster conditions of unrest, to force wages to the highest point, to create as great a balance as possible against us, and may even lead to a rapacious attempt at killing the goose that lays the golden eggs.

In considering this question we must remember that impoverished Europe will allow no consideration of morals or rights to stand in the way of her financial rehabilitation. Europe is after our gold; she is going to get much of it, because we must trade and exchange and we must allow immigration; we cannot lock our doors to all outsiders and retain our wealth within our walls. Such action will reduce us to a parity with China; we should develop a condition that would guarantee a mass attack from European and Asiatic powers.

If an ounce of gold were to be priced at $30 instead of $20, then this marking up of the price would add a ledger increment of from four to five billion dollars to our wealth. It would do us no good to have this increased figure upon our books, for we are surfeited with

gold, both in figures and in bulk. This leads to the debatable suggestion that we give this four billions to our impoverished Allies. Great Britain need not be considered, for she produces from 60 to 70% of the annual increment to the world's supply of gold and she will profit greatly by marking up the price of gold. If such a step could be taken we should place our friends in a position to begin business immediately. Credits could be established, industry in Europe revived, the threatening wave of immigration to this country stayed, the striving of Bolshevists counteracted, and our present invitation for a European propaganda of labor disturbance in this country withdrawn.

Speaking of European conditions, Mr. Frank Vanderlip is reported to have been most outspoken in regard to the distressful condition of Europe. In the course of a recent speech he said: "Now a lot of you may say . . . that the War is over and this tangle is going to work out in the long run; . . . You know that a man with a hungry stomach cannot wait for the economics in the long run; he starves to death. Before he will do that he will go into revolution. This thing would work out in the long run if it were one country, but it is all the European continent, . . . and it won't work out in the long run unless we help it work out. . . . Now Europe has got to save itself. It cannot be done by charity, but we have got to get a little priming in the pump to get the thing started."

I do not for a moment quote Mr. Vanderlip as supporting a change in the status of gold, his instincts as a banker would cry out against such a change, but I do make bold to suggest that a change in the status of gold would bring that commodity back into more general circulation, and would enable some billions of dollars of debt to be wiped out without direct taxation, and that such action might be the priming required by the pump to start it working once more.

There are bonds redeemable in gold, but there is insufficient gold in the world to redeem 5% of such bonds. As these bonds fall due, the demand for gold will increase and such a demand will bring about restricted credits and diminution of trade. If business increases during the next 25 years at a rate commensurate with the increase experienced in the 25 years before the War, then it is probable that the value of an ounce of gold will be nearly double the price. This is an increment of power that we will do well to avoid. We must guard against forces tending to disrupt society, and we should be farsighted enough to uproot a cause tending to generate such forces.

Mr. Vanderlip reports currency conditions in Europe as being chaotic. British paper currency increased to one and a half billion dollars with less than 10% of that amount secured by gold; Austrian kronen notes with less than $\frac{3}{8}$% of gold reserve; French franc notes circulation increased from 6 to 36 billions with a simultaneous decrease in gold reserves; Russian paper money of unknown amount is being circulated without gold reserves. Any plan that will give value to European currency, that will help stabilize it, will help to avert the crisis that not a few thinking observers fear.

Conditions have arisen in the world rendering the old standards of society untenable; humanity is in no condition to abide by those restrictions which are implied by and are necessary to the survival of archaic standards; and any change of standard that will in the slightest degree ameliorate existing conditions is worthy of serious consideration.

Two little pamphlets of very modern political economy adjustments of pertinent interest to myself lie upon my desk. They are 'The War Tax' as passed by the United States Congress in February 1919, and 'An Act to Amend the Income-Tax Act,' recently assented to by the Canadian Parliament. A third pamphlet, of less immediate personal interest, but of interest nevertheless, is entitled 'The Inheritance Tax'. From these three little volumes I deduce that some adjustments are necessary in our political economy. From their pages I gather the message, "To him that hath not shall be given, and from him that hath shall be taken away much that he hath." And I find in this an indirect recognition of the true status of gold.

P. A. Robbins.

San Francisco, July 17.

Protection to the Quicksilver Industry

The Editor:

Sir—Your highly appreciated reference to my letter of June 7, discussing the quicksilver industry, in your issue of the 21st ultimo, encourages me to re-open this subject in your paper, the more so as since then two statements have been published endorsing the policy of leaving the quicksilver industry unprotected. One was made by Mr. W. R. Ingalls, as published and commented upon in your issue of June 28, the other is a letter from Mr. F. F. Sharpless appearing in the 'Engineering & Mining Journal' of July 5, wherein he advances the view that protection of that industry might be a serious burden on the consumers; and that, as the London house of the Rothschilds has not disturbed the quicksilver industry in the United States, such is not liable to occur in the future.

During the latter part of the War it has been suggested that the resources of the various countries should be practically considered as one common asset, in fact, a theory of economic internationalism, in direct contradiction of the pre-war conviction that every country had to develop its resources to the best of its opportunities. The main argument against the protection of the quicksilver industry is based on this theory of economic internationalism. This theory, however, is not yet so generally accepted as to become a safe guide for the regulation of the development of the resources of the different countries, and even in this country, when large interests are at stake, it is flouted. This is emphatically indicated by the offered explanation why the imports of dyes, dye-stuffs, and potash are restricted, in order to protect the dye and potash industries. Why, if the farmer has

to pay higher for his fertilizer in order to protect the infant potash industry, should the quicksilver consumer not help to keep the domestic production of that metal alive? The only reason is that the quicksilver producers are nothing like so influential as the interests behind the dye and potash industries. It does not appear to me that the sentiment of nationalism has lost enough of its influence to allow, as yet, the endorsement of this economic conception by the various nations of the world that are active producers.

The quicksilver producers do not demand an unreasonable degree of protection; most of them would be perfectly satisfied with an assured market price about as it was last year. The danger of the situation lies in the fact that, while in pre-war times the Rothschilds only controlled 34% of the total world's production, they at present control 77.5%; and that, therefore, the conditions are entirely different. In pre-war times the import values were often below the figure at which the Rothschilds can sell on the London market. That being the case, what is there to prevent them now from wiping out their only competitor, and then raise the price to whatever they deem proper, unless the domestic producers are adequately protected?

The decision of the U. S. Attorney-General in the case of the mine operators of the so-called war minerals, claiming indemnity for losses incurred in opening up those mines at the solicitation of the Government, to which you refer in your issue of July 19, is another argument to bring home to the quicksilver producers the absolute necessity for gaining influential backing, and is, I hope, a lesson for them to get together, and to interest the other mineral producers in their case, which thus far they have failed to do.

WILLIAM FORSTNER.

San Francisco, July 19.

The Elm Orlu Case

The Editor:

Sir—In your issue of May 10, 1919, the Elm Orlu case is reviewed by Mr. Searls.

It seems that the Elm Orlu is the senior location, the Black Rock the junior location, and the Black Rock was the first to be patented. Mr. Searls makes this statement: "The Black Rock owners by their prior patent thus gained title to all of the surface of the Elm Orlu", covered by the Black Rock conflict. It seems that the owners of the Elm Orlu claim had full and complete possession of their claim, free from any entanglements, up to the time the Black Rock was located.

Section 2322 U. S. Mining Laws reads: "The locators of all mining locations . . . shall have the exclusive right of possession and enjoyment of all the surface included within the lines of their location, etc." In giving the Black Rock claim the shape of a parallelogram as near as may be, it became necessary, it seems, to lap onto and conflict with the Elm Orlu claim and seemingly without any intention of claiming the conflicted area.

The owners of the Black Rock claim being first to patent are given every foot of ground within their claim-lines, including the conflicted area with the Elm Orlu claim. This puts a burden upon the senior-claim owners wherein they are compelled to go into court and defend rights guaranteed under Section 2322 or forfeit their rights in the land covered by the Black Rock conflict. This is so unjust that it is strange that it should go unchallenged. Why put the burden upon the senior locator? When the junior locator is first to apply for patent, why not demand of *him* that his hands shall be clean, that he shall state in his application for patent that the conflicts his claims make with senior loactions (giving their names) be excluded from the patent. Should he fail to do his plain duty in this respect and the conflicts show up in the Mineral Deputy's report, all patent proceedings should stop until such time as the applicant for a patent shall ask that the conflicted areas be excepted from the patent or else show a deed to said conflicted areas. To do otherwise, to put a burden upon the senior locator, is putting a premium on the bad faith of the junior locator when he is the first to go to patent with claim evidently in conflict with senior locations.

Our Jarbidge mining district is cursed under the same rulings. Junior locators when first to patent are given all the land within their claim-lines, including areas conflicting with senior claims. No doubt this is true in other districts. Under such a ruling it is exceedingly hazardous to permit a junior locator to lap onto or across the claim of a senior location unless the certificate of location states that the conflict with the senior is excepted. Can this unjust ruling be eliminated and the rights of the senior locator respected as guaranteed in Section 2322? I hope so.

A. L. RINEARSON.

Jarbidge, Nevada, July 15.

Methods at the Afterthought Mine

The Editor:

Sir—I have read with much interest the articles by Mr. Lang entitled 'A Metallurgical Journey to Shasta, California'. In your issue of July 12, 1919, I was particularly interested in his description of the methods employed at the Afterthought mine, as I was engaged at the property from 1905 to 1908 as assistant chemist and assayer and during the latter part of 1907 as head chemist. The company was then known as the Great Western Gold Co., the metallurgist and manager being S. E. Bretherton. I am surprised that his name was entirely omitted from the article, as it was he and not Mr. Herbert Haas who made a success of the plant.

Mr. Haas designed and built the original smelting plant at Ingot, tried it several times unsuccessfully, and finally gave it up in the summer of 1905, when Mr. Bretherton took charge of the plant as metallurgist and manager. Mr. Bretherton ran the smelter successfully from the fall of 1905 until January 1908, when the spectacular drop in copper occurred.

Mr. Bretherton added the large blast-furnace, which had a far greater capacity than the one installed by Mr.

Haas, and also installed the Bretherton hot-blast stove, which proved to be far more economical than the U hot-blast stove installed by Mr. Haas. Mr. Bretherton also added the hand-picking belt in order to have the high-grade zinc ore, and it was he who had the various tests made relative to the magnetic separation and flotation in his endeavor to save the zinc, which at that time was being wasted both in the matte and slag and in the gases going out of the stack.*

My opinion is that Mr. Lang has substituted the name of Mr. Haas for Mr. Bretherton, and I think it is no more than fair that I call your attention to what seems to me an error that I trust you will correct.

San Francisco, July 12. FRANK L. WILSON.

The Editor:

Sir—In your issue of July 12 I have read the interesting article headed 'A Metallurgical Journey to Shasta, California'. It is self-evident that the author of this article was misinformed in regard to the development of the Afterthought mining property, with which I am familiar.

On page 52 he says, "Herbert Hass, formerly metallurgist to the company, and introducer of the pyritic method there;" and again on the same page, "Other tests followed, and various processes for extracting the zinc were suggested, but nothing came of it beyond the co-ordination of ideas, and the mine laid practically idle until taken over by the present company, styled the Afterthought Copper Mining Co."†

I wish to correct these statements, especially in regard to the property being practically idle, by stating that during only nine months actual operation of the blast-furnace, when the wagon-roads could be used, we smelted Afterthought ore and sold matte containing values in round numbers for copper, silver, and a little gold (the zinc, which was of more value than the copper, silver, and gold combined, was lost) of $981,000 gross, net value $852,000, after deducting freight and smelting charges. The property was developed from a good prospect into a large mine with an up-to-date smelting plant under my management without any financial assistance from the East—in fact, we had to send money East prior to 1908.

S. E. BRETHERTON.

San Francisco, July 15.

COMPARING last year with the year 1913, the coal output of Great Britain has declined 20.8%, whereas there has been a decrease of only 10.5% in the number of persons employed. As a result, the output per head has fallen from 262 tons in 1913 to 232 tons in 1918. Coupled with the great increases in the wages of coal miners during the past few years, this has had the effect of seriously increasing the price of coal.

*See M. & S. P., of March 14, 1914. 'Leaching of Zinc Ore at the Afterthought Mine', by Frank L. Wilson.

†The present company is now being financed and engineered by the estate of the late John T. Milliken, of St. Louis.

Platinum at Grand Canyon

Referring to the controversy over the existence of platinum deposits in the Grand Canyon of the Colorado, as discussed in our issues of June 15 and September 7 last year, we publish herewith the report of Mr. J. M. Boutwell, whose name has been mentioned in this connection. We are informed by him that he mailed a copy of the report to us on March 18. We did not receive it. Owing to his absence abroad, he was not aware of our failure to publish it until May 27, whereupon he took steps to have another copy sent to us. We received it this week and give it verbatim below.

New York City,
United States Platinum Company, March 8, 1919.
1006 Land Title Building,
Philadelphia, Pa.

Gentlemen:

In accordance with agreement to examine the Indian Gardens property at Grand Canyon, Arizona, to determine its economic possibilities, this ground has been studied geologically, possible ore-bearing formations have been systematically sampled, 275 samples have been assayed in duplicate or triplicate, special chemical work has been done, and duplicate concentration tests have been made.

The assay report on the last of these samples has reached me today, and I now submit herewith my first report.

In all this work the utmost practicable endeavor has been made according to the best known practice to secure correct results as a basis for ascertaining the truth.

These results show that platinum ore has not been found in the ground examined in form and grade of commercial value.

JOHN M. BOUTWELL.

THE NENANA COALFIELD, which lies about 200 miles north of Cook inlet, Alaska, and will be reached by the new Government railroad from Seward, 364 miles distant, has been examined by G. C. Martin, of the U. S. Geological Survey, whose report on it has just been published. The field is about 100 miles south of Fairbanks, the inland terminus of the railroad, and is more accessible to the gold mines of the Tanana valley than any other coalfield in Alaska. The coal is a lignite of good grade which, when the field is made accessible, will be used as locomotive fuel on the railroad, for generating power and for thawing at the gold mines, as domestic fuel in the region, and as fuel on steamboats that ply on Tanana river and possibly on some of the boats on the Yukon. The report gives the classification of the coal land and non-coal land in the field by sections, contains detailed maps showing the areas of coal-bearing and non coal-bearing rocks, and gives detailed statements of the conditions of mining and transportation. A copy of the report, which is published as Bulletin 664 of the U. S. Geological Survey, can be obtained free of charge from the Director of the Survey at Washington, D. C.

Electrolytic Deposition of Copper in the Leaching of Roasted Ore and Concentrate

By PERCY R. MIDDLETON

In a previous article* I gave a general description of some experimental work on the recovery of copper from flotation concentrate by roasting and leaching. As some doubt seems to exist concerning the possibility of using electrolytic deposition for the recovery of copper from the solutions resulting from the leaching of a roasted ore or concentrate, I have compiled the results of my experimental work on this subject, and offer this in support of my statement that electrolysis can be successfully employed in the leaching of either a roasted ore or a concentrate. This article is based on work conducted for several Australian mining companies, including the Mount Morgan Gold Mining Co. The investigations extended over a period of twelve months and were conducted on the solutions resulting from the laboratory leaching of 50-lb. charges of roasted ore and larger-scale tests wherein one ton of calcine was leached per day. In each case the operation was cyclic and extended over a period long enough to investigate thoroughly the effect of the concentrate impurities in the electrolyte.

Before starting the above investigations, I collected all the data available on the subject, and learned that the principal difficulty to be encountered was the presence of ferric iron in the electrolyte. As the solution resulting from leaching of the calcines from my earlier experiments contained large quantities of iron, I started a series of tests to determine the possibility of producing a calcine low in soluble iron, with a satisfactory copper extraction. The first experiments along these lines were conducted in a small hand-rabbled reverberatory furnace, on charges of 50 lb. of ore, and it was found possible to produce a calcine containing under 1% acid soluble iron and 95% of the copper soluble in 5% sulphuric acid, the assay of the ore, before roasting, being 14% copper and 26% iron. These results were confirmed in an Edwards furnace, roasting from 25 to 50 tons of ore per day, and I have found no difficulty in duplicating the results. In large-scale work, the terminal temperature of the roasting operation can be held within 30°C. of any desired figure. This establishes the fact that roasting can be performed on a large scale, at temperatures high enough to decompose the soluble salts of iron, without affecting the copper extraction.

Laboratory experiments were conducted in three cells, arranged in series. Each cell had a cathode area of four square feet; it contained eight copper cathodes and nine lead anodes. The electrolyte was circulated continuously through the cells until reduced to the desired copper content. The reduction of ferric iron was effected in a small absorption tower, made from earthenware pipes, packed with coke. Sulphur di-oxide was generated in a sulphur-burner and entered the base of the tower. Large-scale tests were conducted in a series of five cells, each being 24 by 18 by 28 in. deep. Each cell contained five copper cathodes and six lead anodes, the size of these electrodes being 14 by 24 in. After passing through the cells, the electrolyte was returned to a storage-tank, by means of an air-life. Sulphur di-oxide was introduced into the storage-tanks for the reduction of ferric iron. Power was supplied by a small motor-generator, at the desired voltage.

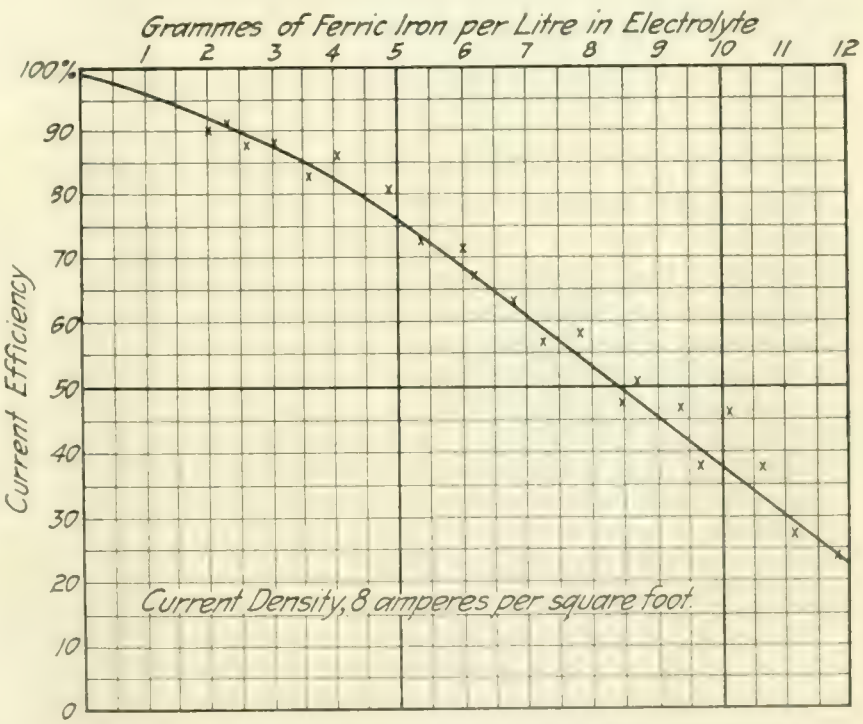


FIG. 1. EFFECT OF FERRIC IRON ON CEMENT EFFICIENCY

Preliminary experiments proved that some means for

*'Recovery of Copper from Flotation by Leaching'. M. & S. P., June 7, 1919.

the reduction of the ferric iron in the electrolyte would have to be adopted before a cyclic process could be used. The effect of ferric iron on current efficiency is shown graphically in Fig. 1. It was found that half the ferric iron was reduced to the ferrous state during leaching, when there were four grammes of ferric iron per litre in the solution. The reduction thus effected during leaching was not sufficient to keep the ferric iron within the desired limits and sulphur di-oxide had to be used before satisfactory results were obtained.

Taking the acid-soluble iron in the calcine at 1%, the theoretical accumulation of iron in the electrolyte, with a pulp-ratio of 2 litres of solution to 1000 grammes of

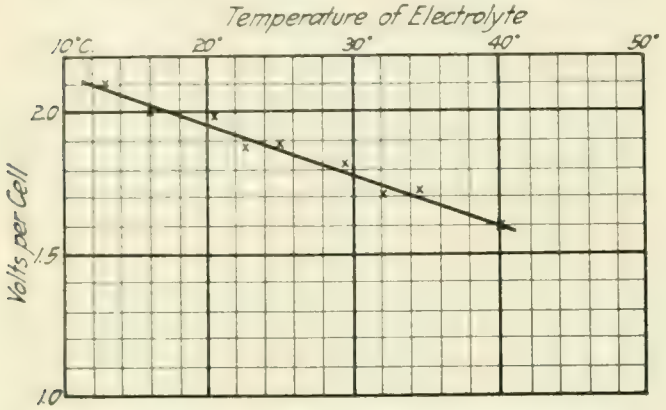


FIG. 2. EFFECT OF TEMPERATURE ON CELL VOLTAGE

calcine, will be 5 gm. of iron per litre at each cycle. If it is desired to keep the total iron content of the electrolyte constant at 30 gm. iron per litre, it will be necessary to discard one-sixth the volume of the solution at each cycle. In actual practice it was found that the increase in iron was below this calculated amount; apparently the iron salts in the calcine are more readily soluble in barren sulphuric acid than in the electrolyte. The average amount of solution discarded was equal to one-tenth the volume of the electrolyte, when the calcine contained 1% acid-soluble iron.

If the copper content of the electrolyte is reduced to 15 gm. per litre, at each cycle, and the discard is made after electrolysis, the amount of copper to be precipitated on scrap-iron will be 6 lb. of copper per ton of calcine treated, when the pulp-ratio is 2:1 and the soluble iron content of the calcine is 1%. This amount will be constant, irrespective of the original copper value of the calcine. It would be commercially possible to electrolyze this discarded solution down to 7.5 gm. copper per litre, with the result that only three pounds of copper per ton of calcine treated would have to be precipitated on scrap-iron.

In both the laboratory experiments and the larger-scale tests, the regeneration of acid averaged 2.1 units of sulphuric acid per unit of copper deposited. This amount of acid was more than sufficient for the requirements of the process, even after discarding the necessary amount of solution at each cycle; in fact, an increase of acid was noticed at the end of the experiments.

In all experiments, provision was made for heating the electrolyte. The effect of temperature on cell-voltage is shown in Fig. 2.

The most satisfactory current-density was found to be between 8 and 9 amperes per square foot. Higher current-densities resulted in a lower current-efficiency, irregular cathode deposits and short circuits caused by the copper 'growing' across to the anode.

At the conclusion of the investigations, an examination of the lead anodes was made. Some scale had formed, but corrosion was not excessive in either the laboratory or larger cells.

Laboratory experiments were conducted on an ore containing a certain amount of zinc. Zinc sulphate accumulated in the electrolyte, together with iron sulphates, and it was found that the zinc sulphate had a restraining action on the corrosion of the cathode copper by ferric sulphate. With 40 gm. zinc per litre in the electrolyte it was possible to carry 20% more ferric iron without a corresponding loss in current efficiency. Fig. 3 shows the effect of zinc sulphate on current efficiency.

Ferric iron in the electrolyte is the principal cause of low current-efficiency. Other factors come into play, but

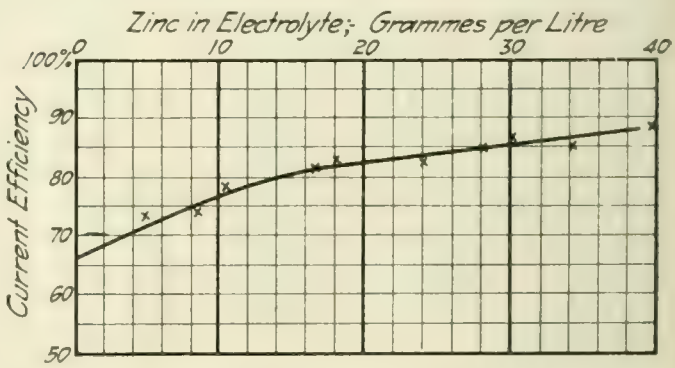


FIG. 3. EFFECT OF ZINC SULPHATE ON CURRENT EFFICIENCY

usually these are readily overcome. Ferrous iron, within reasonable limits, does not seem to affect electrolysis when lead anodes are used, but the lower the ferric iron, the better will be the results. Large-scale work showed a current-efficiency between 85% and 90%; laboratory tests were slightly higher.

The average power consumption was one kilowatt-hour for every 1.2 lb. of copper deposited.

The percentage of copper in the cathodes was not as high as in standard electrolytic copper, but the impurities would be practically eliminated in the melting.

In conclusion, I would like to state that I do not claim anything original in the above procedure. My investigations were conducted with the object of determining whether electrolytic deposition of copper could be successfully applied in the recovery of copper from sulphide ores by roasting and leaching. It was necessary to either evolve a new method of electrolysis or reduce the acid-soluble iron in the calcine; the latter was found to be the most practical and was thoroughly demonstrated on a large scale under actual working conditions.

THE MILLS OF THE AFTERTHOUGHT

The Horwood Process as Applied to the Copper-Zinc Ore of the Afterthought Mine

By A. H. HELLER

The ore at the Afterthought mine in Shasta county, California, has baffled treatment for years. The processes tried in the early history of the mine included hot-blast smelting and ammonia-carbon di-oxide leaching. In 1916 J. T. Milliken of St. Louis undertook to operate the property, and experimental work was at once started. Tests with gravity concentration were first made, but owing to the sulphides being in too fine a state and the large amount of barite in the ore, separation by gravity was impracticable. Next, tests with selective flotation, by aid of reagents, were made, both at Denver and Salt Lake City. These also were without success, although later developments of this process have shown that there is a possibility of its being applicable to ores such as those of the Afterthought.

After sundry failures with several different methods the Horwood process was tried. This had proved a part success in Australia on lead-zinc ores, but it was known that very little information could be obtained from work done in Australia, and that the application of the process to the Afterthought ore would be attended by more difficulties than those presented by lead-zinc ores. With complex ores of lead and zinc, the sulphate film formed on the lead sulphide in roasting is insoluble in sulphuric acid, whereas the oxide film formed on copper sulphide of a copper-zinc ore is more or less soluble in this acid, so that it cannot very well be employed in subsequent flotation. It is known that acid helps the flotation of zinc sulphide. Another difficulty to be expected with copper-zinc ores, and not with those of lead-zinc, is that sulphates of copper form during roasting and cause trouble in the handling of the pulped calcine. At the same time the presence of a certain amount of copper sulphate in the pulp is also advantageous, the reason for which will be explained later.

Another treatment applicable to this ore was the electrolytic process. The only reason why this process was not tried at this time was because it was a method still in the experimental stage, the development of which would have entailed an expense unwarranted by the known reserves of the mine. The operators had foresight enough to see the possibilities of the electrolytic process, so that all equipment and buildings furnished for the Horwood process could be used to advantage in the electrolytic process in case they should decide to adopt it at a later date.

Tests with the Horwood process were so promising that it was decided to build a 300-ton plant, the construction of which was started in April 1917. Enough of the plant had been completed in September to test the practicability of the process. In December the plant was shut-down to provide storage for the concentrate, to improve the flotation machines, to finish the dryer, and to alter the roaster. Being pioneers in the process as applied to copper-zinc ores, the management could obtain no outside experienced help, so that numerous unforeseen problems had to be solved by trial. Owing to the increase in freight-rates and the necessity for some important changes in the flow-sheet, and the general operation of the plant, the mill was shut-down in June 1918. Work was immediately begun on the construction of an Edwards cooler for the roasted product, a rever-

beratory furnace for the copper concentrate, and, in order to simplify the flow-sheet, a new preferential flotation unit was built, and a different style of flotation machine introduced. It was not expected that better results would be obtained with this machine, but that the cost of operation would be much less than with the Janney machines.

A start was again made in December 1918, and all improvements came up to expectations, with the exception of the new flotation unit, which fell down entirely. To switch back to the old method of flotation would have entailed considerable expense, since practically everything in connection with the old system had been dismantled. With the drop in the price of the base metals, and recent developments and improvements in the electrolytic process, it was decided to adopt this method. Before the last shut-down results with the Horwood process were almost entirely dependent on the roast obtained, but during the interval improvements were made in roasting so that there was absolute control of conditions. A mistake, however, was made in the method of flotation, and by going back to the old conditions of flotation it is known exactly what results might be expected with the Horwood process, as applied to this or similar ores.

THE ORE. The ore of the Afterthought mine as delivered to the mill has the following composition:

Silver	5.50 oz	Lead	0.80%
Gold	0.03 oz.	Sulphur	18.80%
Copper	3.10%	CaO	8.70%
Zinc	16.80%	Al_2O_3	1.00%
Iron	9.30%	Insol. (barite and silica)	24.30%

The following is the approximate mineralogical composition:

	%		
Chalcopyrite	10	Sulphides	45%
Pyrite	9		
Blende	25		
Galena	1		
Calcite	15	Gangue	55%
Barite	12		
Quartz and slate	28		

The specific gravity of the ore is high, being about 3.5. The collective concentrate has a specific gravity of 3.93.

METHOD OF TREATMENT. The ore is crushed to 2-inch ring and ground to pass 48-mesh; it is then subjected to flotation, producing a collective concentrate and a final tailing. The collective concentrate is thickened, filtered, dried, and roasted lightly. After cooling it is subjected to flotation again, this time producing a froth called the zinc concentrate and a tailing called the copper-iron concentrate. These concentrates are then filtered and dried.

The milling equipment is as follows:

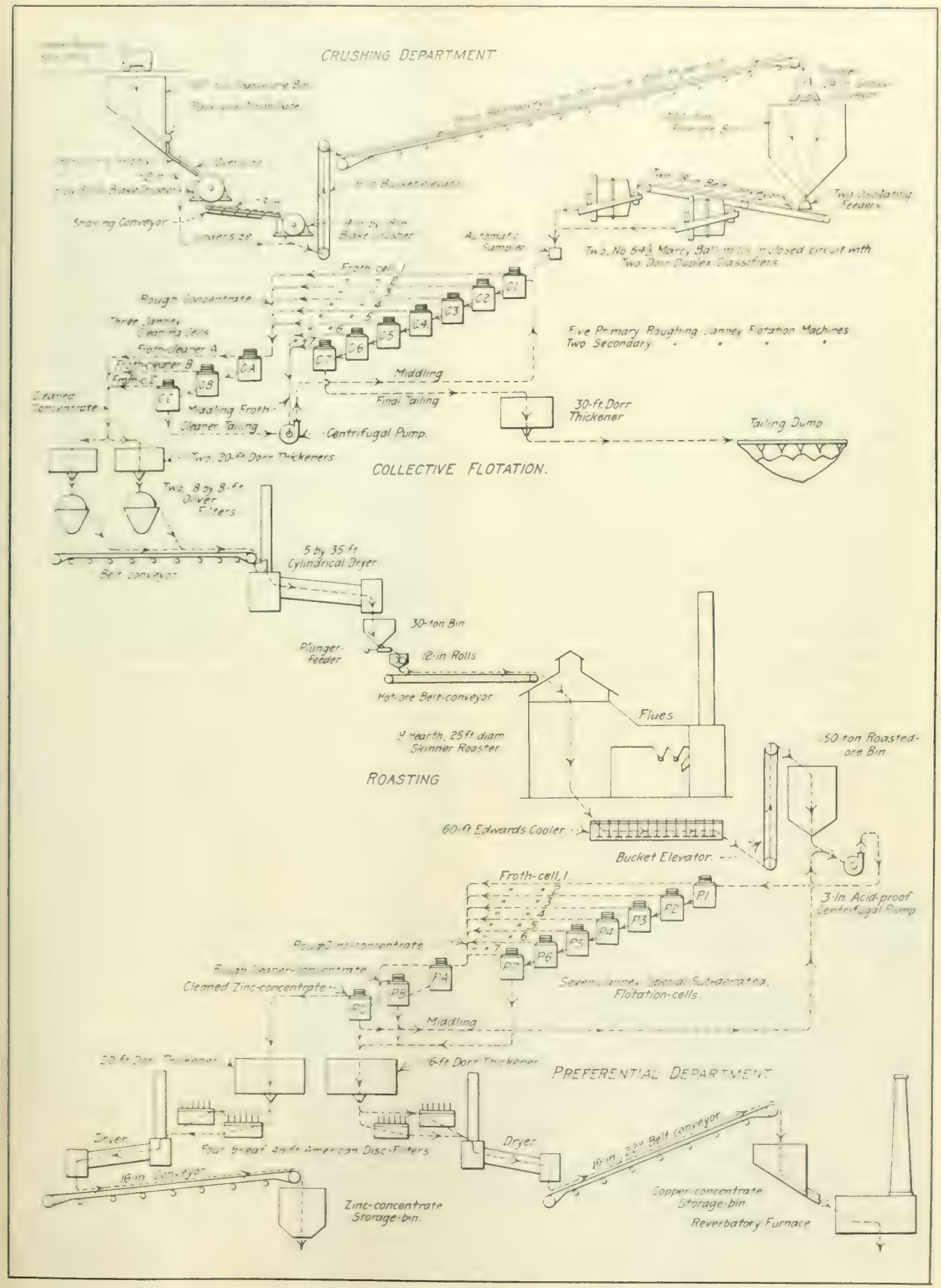
Coarse and fine ore-bins
One 15 by 30 in. Blake crusher
One 9 by 18 in. Blake crusher
Elevator and two conveyers
Oscillating feeders
Two No. 64½ Marcy ball-mills
Two Dorr duplex classifiers
Two 3-in. Krogh sand-pumps
Two 4-in. Krogh sand-pumps
One 30-ft. Dorr thickener
Two 21-ft. Dorr thickeners
Two 16-ft. Dorr thickeners
20 Janney sub-aerated flotation machines
Two 8 by 8-ft. Oliver filters
Three 30 by 5-ft. cylindrical dryers
One 25-ft. 9-hearth Skinner roaster
One 60-ft. Edwards cooler
Four 4-ft. 6-disc American filters.

THE TONNAGE treated is a minimum of 275 per day, with a maximum of 400 tons. This produces about 150 tons of collective concentrate or a ratio of concentration of about 2:1. This collective concentrate when treated preferentially gives 60 tons of copper concentrate to 90 tons of zinc concentrate.

THE CRUSHING PLANT is at the bottom of the mill, to allow of sufficient grade for the railroad from the mine. The ore is dumped into a 500-ton bin, from which it is drawn through a heavy rack-and-pinion gate, with counterweights to permit ease of operation. A grizzly-feeder was originally installed but owing to insufficient space it was rejected. After passing over a stationary grizzly with 2-inch openings, the ore is crushed to 3 inches by a 15 by 30-in. Blake crusher. The discharge is conveyed by a shaking conveyor to a 9 by 18-in. Blake crusher. This conveyor replaced a shaking grizzly, which proved a failure on account of the tough character of the ore, which breaks into pointed and angular pieces, tending to clog the grizzly. The discharge of the 9 by 18 Blake joins the material from the 2-inch grizzly and is elevated 50 ft. in a 16-in. bucket-elevator to a 20-inch conveyor 220 ft. long and running at 400 ft. per minute on an incline of 20°. This conveyor discharges onto a cross-conveyor, which in turn discharges through a tripper into a 1000-ton ore-bin at the top of the mill. A shuttle-conveyor, originally ordered to take the place of the cross-conveyor, was held up on account of war orders. A sampling-plant was provided in the crusher-building, but, owing to the inability to obtain the equipment at the time, it was thought advisable to do the sampling ahead of flotation.

GRINDING. From the bins the ore is drawn through two oscillating feeders and is fed by short conveyors to two No. 64½ Marcy ball-mills each running in closed circuit with a Dorr duplex classifier. The classification is good. Each mill handles about 160 tons per 24 hours. Owing to the high specific gravity of the ore, the classifier is run at a speed of 30 strokes per minute. About 800 tons of material per day is returned to the mill by the Dorr classifier, making a total of about 1000 tons of material passing through the ball-mill in 24 hours. To each mill approximately 11 gallons of water per minute is added, and the water added at the mill-discharge and classifier amounts to 37 gallons.

The reagents for collective flotation are added at the head of each ball-mill by means of disc-feeders. One Marcy mill is left-handed and the other right. Each is driven by a 125-hp. motor through a Lenix drive with endless leather belt. These drives give little or no trouble. Five-inch forged chrome-steel balls are used, and the mills operate at 28 r.p.m.



FLOW-SHEET OF HORWOOD PROCESS IN THE AFTERTHOUGHT MILL

The following is a typical screen-analysis:

Mesh		Ball-mill discharge 25 % water 3.05% Cu, 17.8% Zn 953 tons		Classifier overflow 65% water 2.86% Cu, 17.1% Zn 150 tons		Classifier sand 15% water 3.16% Cu, 20.4% Zn 803 tons	
		% Indiv	% Accum	% Indiv	% Accum	% Indiv	% Accum
Plus	10	6.14	6.14	.	.	7.58	7.58
10–	20	11.27	17.41	....	....	16.58	24.15
20–	30	1.40	29.71			11.18	35.34
30–	40	12.91	43.62	0.56	0.56	20.00	55.34
40–	60	15.30	58.92	4.43	4.99	15.16	70.50
60–	80	7.18	66.10	4.98	9.97	10.17	80.67
80–	100	6.43	72.53	8.29	18.26	6.18	86.85
100–	150	3.80	76.03	9.40	27.66	4.57	91.42
150–	200	4.60	80.63	4.98	32.64	2.59	94.01
Minus	200	20.00	100.63	67.36	100.00	5.98	99.99

Collective Flotation. After leaving the classifier the pulp is sampled automatically and then goes direct to 10 sub-aerated Janney machines, ten per unit. Each unit consists of seven roughers and three cleaners. There is ample room in the mill-building for another unit of flotation cells. With the first equipment two Janney emulsifiers were used per unit; they were re-modeled into cells similar to the standard Janney machine.

The flow is so arranged that concentrate may be taken direct from the first two Janneys and sent to the storage tanks or they may go to the cleaners. The froth from the last two roughing-cells may go either to the cleaners or be returned to the head of the roughing-cells. The rough concentrate may be cleaned in three Janneys or cleaned in two and re-cleaned in a third. The tailing from the cleaners is returned to the head of the mill by means of three-inch sand-pumps arranged in duplicate. These pumps replaced an elevator, which gave considerable trouble on account of the accumulation of froth.

In all preliminary tests it was necessary to use acid, the consumption of which was prohibitive on account of the lime in the ore. Finally an oil (Barrett No. 609) was found that gave good results without acid; it had both collecting and frothing qualities. This oil was the one most generally used during 1917 and the first part of 1918. It is undoubtedly a coal-tar creosote mixture containing some phenol, in cold weather throwing down a precipitate that is some naphthalene compound. Without this precipitate in solution the No. 609 oil gives poor results. Through small-scale experimentation with various oils it was found that a mixture of stove-oil with Pensacola No. 80 gave even better results, besides being a cheaper mixture. The oil is stored in a house above the mill and flows by gravity to the feeders at the ball-mills. Oils as well as other mill-supplies are carried up by means of an electrically operated incline tram running the full length of the buildings. In the use of this last mixture it will be found advantageous to add the stove-oil at the ball-mills and the frother by a step-oiling system to the various flotation cells.

It was found that results could not be improved by separating sand and slime, and treating each individually as is done in some plants. The ratio of concentration on the collective cells is about 2:1. Owing to the trouble caused in the roasting, it is not advisable to obtain a concentrate too high in sulphides. The ore without a certain amount of silica roasts too quickly and in so doing partly films some of the sphalerite, causing poor results from preferential flotation. The point at which it is desired to hold the collective concentrate is about as follows: 30% zinc, 6% copper, 18% iron, 10% insoluble, 6% alumina, 4% lime, or, in other words, about 20% gangue. On the other hand, too low-grade a concentrate gives a low-grade copper product in preferential work.

In the collective department the recovery of copper is about 90% and of the zinc about 85%. The first few cells of collective concentrate show higher copper and lower zinc contents than the last few cells; and this, together with the recovery, points to the fact that the copper sulphides are more easily floated than the zinc sulphide, with a decided preferential action for the former. If the collecting-oil is not added at the ball-mill the recovery suffers immediately. For this reason laboratory results do not come up to mill results, when the oils are added to the test-machine.

The cleaned collective froth, containing 25% solid, goes to two 21-ft. Dorr thickeners. Sprays are used to break down any froth that accumulates on the thickeners. The overflow from the thickeners contains 2% solid and is returned to the mill-circuit. The thickener discharge, which contains 75% solid, runs by gravity to two 8 by 8-ft. Oliver filters. These filters discharge a cake averaging 15% moisture. The use of steam decreased this moisture slightly and increased the tonnage of each filter about 17%.

Drying and Roasting. The filter-cake falls upon a belt-conveyor, which carries the concentrate to the drying-plant. The dryer is of the cylindrical type, 30 ft. long by 5 ft. in diameter. Oil is used for fuel. The attendance required is small, the filter operator having the dryer plant under his supervision. The dryer is efficient and the cost of drying is low. The average moisture in the dried product is 5%. Care must be exercised that it does not get below this, otherwise the discharge will be too hot, and cause trouble not only in feeding, but will tend to burn the belt-conveyor carrying the material to the roaster.

The dryer discharges into a 30-ton hopper. From this it is drawn by a plunger-feeder onto the roaster belt-conveyor. The plunger feeder replaced one of the disc type, as the hot concentrate tended to flow and give an unsteady feed to the roaster. The belt-conveyor passes through two rolls to ensure the breaking of the lumps formed in drying.

Flue losses in the dryer are small, about ten tons being collected monthly. With a sticky concentrate the dryer tends to clog, necessitating hammering occasionally with a mallet from the outside. The placing of short chains in the dryer would prevent this trouble.

The concentrate from the dryer is fed to the top, or drying hearth, of a 25 ft. 9 hearth Wedge type Skinner roaster. This roaster has a speed of approximately one revolution per minute. Mechanical trouble was practically nil during a year's run. For a long time it was thought that the success of the entire process lay in the roasting, and more attention was given to this than to

ENTRANCE TO ADIT

any other operation. It was finally discovered that the roasting was not as important as believed, but that regardless of how good the roast was, unless the ore was properly cooled, results would be poor. With the right kind of cooling there is a range of temperature on which successful roasting could be ensured.

As originally built each hearth was completely bricked in, with the exception of two doors. This, it was found, made the roaster hard to regulate, and held too much heat, causing a high temperature, which oxidized the blende. The brick on the lower five hearths was removed and replaced with sheet-iron doors, which give more radiation and facilitate control. With a Wedge, or similar iron-sheeted roaster, it would have been impossible to do this. At the same time a vertical gas-offtake was installed so that the heat and gas could be drawn from one or all hearths, permitting rapid cooling of the roaster in case of too high a temperature. This proved most useful.

No troubles being traced to the cooler and thinking that poor results at the start were due to too long a roast, it was decided to feed the concentrate on the fifth hearth. Later this was changed back to the ninth again. Also, in first starting the roaster heat was applied through the muffles, but as it was necessary to put on or take off the heat quickly at times, this was not satisfactory, and the fire was applied directly to the hearths.

Under this system good results were obtained when treating only 75 tons of concentrate per day. The heat was applied on the seventh hearth by means of oil-burners. An auxiliary burner was kept on the fifth hearth. The fuel could be turned off for days at a time, after having once heated up the furnace to the proper temperature, but it was found that a better control could be maintained with a constant light fire. On this small tonnage No. 8 and 9 hearths would be dark; No. 7 a glowing red; six a cherry-red; five a very dull red; on No. 4 the red color could just be seen; No. 3, 2, and 1 were black. Under these conditions the concentrate was receiving its oxidation on the lower hearths of the roaster, the doors of hearths No. 1, 2, 3, and 4 being wide open the greater part of the time. But there was still trouble in keeping the lower part of the hearth cool; this was finally corrected on a 75-ton basis, but when treating 150 tons of concentrate per day (the output of the concentrator) it was practically impossible to keep the lower hearths cool. The color of the roast after cooling varied from straw-yellow to black, a so-called perfect roast being of a reddish brown color, by reason of the mixture of red oxides of copper and iron with the gray-black sphalerite.

In test-work it was found that if the concentrate was properly roasted, and left to cool gradually, the copper and iron would get the right amount of oxidation and have the characteristic brown color, but if after roasting it was dumped on a cold bucking-board the concentrate

THE AFTERTHOUGHT MILL

would have a black color and when put in a flotation machine the copper and iron as well as the zinc would float, the preferential action being killed entirely. Many theories were advanced as to the exact cause of this. The first was that the copper and iron in roasting had become slightly oxidized and that in chilling this film was cracked, exposing the copper and iron sulphides. The second theory was that magnetic sulphides of iron and copper together with magnetite were formed (as the whole mass was magnetic), and that this was the cause of the concentrate floating (magnetite being more or less floatable).

After these tests had been made, samples of the roasted product were taken and cooled slowly; this gave good preferential results; so everything pointed to the fact that most of the trouble was in the cooling. The concentrate at this time was going through a 20-ft. Baker cooler, taking about three minutes to travel from the intake to the discharge. In cutting down the speed to give the concentrate a longer cooling it was found that the discharge tended to bank up. A helix was then put in, and by cutting down the speed of the cooler the concentrate was held 11 minutes. As cold water was being run into the cooler-vat, someone suggested that we "heat the cooler," and this was tried by letting the water come to a temperature of 90°, holding it at this point. The retardation of the cooling gave better results at once. A still further improvement was made by blowing air through the cooler; this tended to expel the sulphur di-oxide and gave the warm concentrate fresh air for oxidation. However, on a 150-ton basis, when the entire hearth-area had to be used for roasting and none could be used for cooling, the discharge was too hot for the cooling capacity. If the heat was held at the upper part of the roaster the concentrate discharged in a partly roasted condition. The only thing that was now needed was more cooling capacity and Mr. Milliken at once undertook to build a 120-ft. Edwards cooler. At the same time he installed an automatic recording pyrometer, which gave a record of the heat of all hearths at all times. The temperature of the hearths for obtaining good roasts should be not more than 920°F. on the hottest hearth (4th from the top) to 400°, or lower if possible, on the bottom hearth.

More or less copper sulphate was formed during roasting. When the ore was chilled there was but a trace, but with over-roasted ore the copper sulphate was at its maximum. By taking the best roasts and determining the sulphate, the proper amount of sulphating for a good roast was obtained. Every hour it was the duty of the roaster attendant to make a colorimetric analysis of the roaster discharge. A peculiar fact about the sulphating was that the proper roast gave the right amount of sulphating for good flotation work, for it was found that, regardless of the roast, if this copper sulphate was removed the preferential results would be poor. The copper sulphate evidently helps the flotation of the zinc, besides keeping down the copper. The following is a comparative test:

Oils: 50% fuel 50% P T & T No 80.
One 10 minute dull red roast
Temperature flotation 60 F
Test No. 1. Soluble contents filtered out.
Test No 2 Soluble contents retained

Test 1

	Weight	Assays		Recoveries	
		Cu	Zn	Cu	Zn
	Gm	%	%	%	%
Copper concentrate	167	6 80	38.2	67.2	67 4
Zinc concentrate	119	4 73	26 1	32.8	32 6
Test 2					
Copper concentrate	136	9.12	13.1	68 6	20 3
Zinc concentrate	157	3.62	44 6	31.4	79 7

For a long time the sulphur burnt off in roasting was as high as 50%, which meant that more or less of the blende was affected. This was soon remedied.

Under roasting, I have endeavored to give the most important of the metallurgical troubles encountered, all of which were finally overcome. What should be the proper roast it became hard to determine, because at times when it was thought that the roast was good the results were poor and the reverse was equally true. For the first few months there were times when the roaster became white-hot, then in cooling it would chill too quickly. Again, notwithstanding the good ventilation of the roaster-building and frequent cleaning of the flues, the sulphur gas was so strong that one could hardly enter the building without a mask. The following is a set of instructions issued to the roaster attendants:

A. If for any reason roaster is stopped, have rabbles pointing in a NW-SE direction out of line of the burner flames.

B. If sulphides are burning in screw-conveyor leading to cooler or if roaster-discharge is red, it means that the heat is too low in the roaster. The heat may be brought up

1st. By increasing fires on 7th hearth.
2nd. By cutting down amount of feed to roaster.
3rd. If serious, by ringing off feed, stopping roasters for two minutes at a time and turning one revolution, wait two minutes, etc.

C. Size of fire: Do not change without authority of shift-foreman.

D. Sulphating: Color No. 2 best. Test every hour.

E. Panning-tests. Make one every hour. Compare with good roasts.

F. If panning-tests vary much from the brown color desired, report same at once to shift-foreman.

G. Look at all seals at least once on a shift.

H. Do not open or close doors without orders from shift-foreman.

I. Oiling: Line-shafting twice per shift; roaster-bearings once per shift.

J. Power off: Shut off feed and lower fires. Turn roaster once every five minutes.

K. Empty hearths denote clogged seals.

L. Do not go to top of roaster without mask or respirator.

M. Do not let level of cooling-water get below overflow.

N. Cooling-water should be steaming slightly.

Preferential Flotation. The roaster discharge, after going through a mechanical scraper for removal of lumps, passed through the cooler and was then elevated to a conveyor running to the top of the mill, where it discharged into a sludge-tank, water being added before drawing it out to the flotation machines. Owing to

the high dust-losses this method of conveying was discarded and a pumping system installed, using three lifts of 80 ft. each with two-inch Krogh sand-pumps in duplicate. Trouble was caused by the presence of copper sulphate; this was overcome to a great extent by the use of wood-stave pipe-lines and corrosiron liners, with aluminum bronze impellers for the pumps. The liners were imbedded in cement. This pulp then went through seven roughing and three cleaning Janneys. Here also sulphating caused trouble. The copper sulphate would precipitate on, and eat out, the return-pipes, liners, housings, and impellers. Calcium sulphate would also clog the mats, so that, unless prevented by pounding, the pores of the mats would be closed entirely in a week.

In February 1918 a change was made in the design of the Janney machines by making the liners and cells entirely of wood, with spitzkasten similar in design to the mechanical Janney, but much shallower, so that there was but a foot lift from the bottom of the 'spitz' to the cell. The return from the spitskasten to the cell was also made of wood. The large 45 by 45-in. iron air-pans were then cut in three pieces, each 15 by 45 in., and one placed in each spitzkasten on an angle, below the discharge from the cell. These mats could then be lifted out readily in case of a choke-up, or if the mats needed renewing. Air entered the top of the mat instead of from the bottom. The impellers were made of bronze. These machines worked so well that it was decided to install a Minerals Separation machine similar in design near the roaster, so as to avoid elevating the roasted product, at the same time giving more capacity for the collective flotation.

The reason for the installation of the Minerals Separation machine was that it was thought that there would be more ease of operation, because all the cells would be in view of the operator at one time, and the flotation of the roasted product could thus be controlled more easily. The Janneys, as remodeled in the main mill, had given excellent results when the concentrate was properly roasted, and cooled, but there was considerable expense in pumping the pulp 300 ft. to the top of the mill, and the preferential flotation Janneys were not compact enough. By installing the M. S. machine near the roaster a better control could be had, while the Janneys could be used for collective flotation. In this particular case the Minerals Separation machine fell down, first because of the capacity of the machine and second because of the lack of agitation. The agitation given by the Janneys, even though so much greater than that obtained by the M. S. machine, was not sufficient alone to give good results on the first cells, and without some method of cleaning the zinc particles by pumping or emulsifiers at the head of the Janneys the best concentrate would not appear until the third or fourth cell. With the M. S. machine the only time any froth at all was formed—and then it appeared very much over-oiled, owing to lack of agitation—was when the concentrate was a little underroasted. With this pulp under the old conditions, the Janneys could have yielded a froth that would have buried the mill. It is absolutely necessary to have a sub-aerated type of machine, in that the froth formed is slow-moving, and must be removed as soon as formed. With sufficient pre-agitation and the use of sub-aerated acid-proof Janney machines as remodeled at the Afterthought mill excellent results should be obtained with the roasted product as obtained under the conditions as finally perfected.

At first acid and heat were used in preferential work with G. N. S. No. 8 and 28 oils. After much testing, suitable oils were found giving better results and not requiring either acid or heat. Approximately 4 pounds of oil per ton of ore is used.

Flotation results varied with roasting and cooling conditions. At times there was no froth at all, and then again there was so much froth that it could not be handled. An over-roast gave a thin brittle yellowish-brown froth; an under-roast a high voluminous gray froth. A chilled roast gave a fluffy high jet-black froth, while a good roast was of a brownish-black color. Under proper conditions the zinc concentrate was gray, and the copper concentrate a brilliant red. Analysis of the products produced by preferential flotation are about as follows:

Zinc concentrate—2.6% copper, 47.1% zinc, 4.2% iron, 3.3% barite, 4.4% lime, 3.8% alumina, and 3.2% silica.

Copper concentrate—7.2% copper, 12.3% zinc, 23.4% iron, 8.2% barite, 10.7% lime, 10.5% alumina, and 10.4% silica.

There is about eight ounces of silver per ton of each concentrate. These results should be considerably improved by the new cooling system, as tests on a properly cooled ore have given as high as a 55% zinc concentrate, and a 10% copper concentrate containing but 5% zinc.

Thickening, Filtering, and Drying. Two 16-ft. Dorr thickeners are provided for the zinc and copper concentrates. From each of these thickeners the pulp is drawn to one of four 6-leaf 4-ft. American filters—two for the copper and two for the zinc concentrate. The pulp to the filters contains about 25% moisture and is dewatered to 15%. The American is the only type of filter that could be used economically on these concentrates on account of the calcium sulphate present; this quickly closes the pores of the canvas. The life of the canvas filtering-bags is not more than two weeks, but the bags are cheap and can be changed by the attendant while the filters are in operation. With a drum type of filter it would be impracticable to change a cloth every ten days. From the filters the concentrate is conveyed to cylindrical dryers, of which there are two, similar to the collective dryer. These dryers discharge into storage-bins. The copper concentrate is treated locally and the zinc concentrate is sent to Oklahoma.

Tailing from the collective department is partly dewatered in a 30-ft. Dorr thickener. The dewatered tailing is run to a dam modeled after the Inspiration system, placed in a canyon adjacent to the mill. The tailing-launder as it passes over the dam has 18-in. cones every ten feet, which thickens the dam-building material. The

overflow from these cones settles ahead of the dam, and the water is drawn off clear in order to avoid pollution of the stream.

Costs. Although there are not enough data available as to what the exact operating cost of the Horwood process would be on 300-ton basis, from costs of the process obtained during the spring of 1918, the following would be a close estimate:

	Cost per ton
[illegible]	$0.080
[illegible]	0.012
[illegible]	0.014
[illegible]	0.250
[illegible]	0.100
[illegible]	0.150
[illegible]	0.050
[illegible]	0.120
[illegible]	0.300
Tailing-disposal	0.020

	Cost per ton
Assaying	$0.060
Lighting and heating	0.042
Supervision	0.120
Drying	0.100
General	0.130
Maintenance and buildings	0.020
Plant and machinery repairs	0.025
Royalty	0.500
Total	$2.093

Conclusion. Considering how little was known concerning the Horwood process as applied to a copper-iron-zinc ore, rapid progress has been made with this system at the Afterthought mine. The plant ran intermittently for over a year, and shut-downs were only made to improve the practice and install machinery, until the drop in price of the metals and development of the electrolytic process showed that this latter process would be best on this ore. With a high power-rate, which would make the electrolytic method out of the question, or with a cheaper freight-rate and higher metal-prices, undoubtedly the Horwood process as developed at the Afterthought mine would be best suited to this ore.

The flow-sheet now has the same outline as when the plant was first started. The most important improvements made were in the kind and cost of reagents; the steady regulation of the roaster for a low temperature; the removal of lumps from the feed to the roaster and from the feed to preferential flotation; a change in the method of cooling; and in the position of the preferential plant; the drying of the copper and zinc concentrates, and the local treatment of the copper concentrate.

The field for the Horwood process today is limited, since on ores upon which fairly good results may be obtained by gravity or gravity and flotation methods the Horwood process could not compete. The same is true of a complex ore where the electrolytic process is practicable. Notwithstanding recent developments of the Bradford and allied processes, and the higher initial and operating costs of the Horwood, there is no doubt that the Horwood process will give better results in some cases than can be expected with the wet preferential methods.

The Free Gold Pigot Bay Mining Co. was incorporated in Valdez, Alaska, recently by a number of local men, the incorporators being B. F. Millard, of Seattle, Washington, and W. R. Millard and C. B. Smith, of Valdez, the object being to conduct and carry on the business of mining, milling, and smelting. The property of the new company is located at Pigot Bay, Prince William Sound. The company is capitalized at $350,000 and none of the stock is preferred. The number of shares is 350,000, with a par value of one dollar per share.

Tungsten Uses and Minerals

Tungsten is used chiefly as an alloy with iron and carbon, in the production of the so-called 'high-speed' steels. These steels contain from about 13 to 20% of tungsten and usually a certain amount of chromium, and because of the fact that they do not lose their temper at a dull-red heat as do ordinary steels, it is possible to run lathes using tungsten-steel cutting tools five times as fast as with ordinary steel tools. This property of tungsten-steels has had a revolutionary effect in machine-shop work, increasing the output and consequently cheapening production of all kinds of machined parts in automobiles, tractors, locomotives, and the like. Tungsten is also used alloyed with steel in permanent magnets, as it causes the magnets to retain their strength much longer than they otherwise would. Another use is for the filaments of incandescent electric lamps. When used in this way it is usually alloyed with the element thorium which prevents the filament from crystallizing and breaking as it otherwise tends to do. A tungsten filament lamp uses far less electricity for the same amount of light than a carbon filament lamp and by the use of these lamps millions of dollars are saved annually. Tungsten has been used to a slight extent in the manufacture of crucibles for use in vacuum furnaces. By far the larger part of all tungsten mined, however, is utilized in the manufacture of the 'high-speed' steels.

Tungsten is by no means a common element in the earth's crust, it being usually classed among the rarer metals. It occurs in nature in the following minerals:

Scheelite, $CaWO_4$ (calcium tungstate). Scheelite occurs in quartz veins, associated often with gold and with pyrite, in contact metamorphic deposits, in crystalline rocks, and occasionally in placers derived from one of the above.

Wolframite, $(FeMn)WO_4$ (iron manganese tungstate). Its occurrence is similar to that of scheelite, and it is typical of the deep or high temperature zone of vein or mineral formation.

Ferberite and Hubnerite. These are less common tungsten minerals than the two preceding, and either of them grades into wolframite. Ferberite is iron tungstate, $FeWO_4$, and hübnerite is manganese tungstate, $MnWO_4$.

Tungstite or Tungstic Ocher. A yellow powder having the chemical formula of $WO_3 \cdot 2H_2O$. There is no record of this mineral being mined as an ore of tungsten to any extent.

Stolzite, $PbWO_4$, and Cuprotungstite, $CuWO_4$ or $(CaCu)WO_4$ are rare minerals, not known to occur in commercial amounts.—D. C. Livingston, in Bulletin No. 2 of the University of Idaho School of Mines.

The output of Japanese coal mines during the last seven years was, in tons, as follows: In 1912, 15,709,663; 1913, 17,050,267; 1914, 17,289,861; 1915, 15,488,828; 1916, 17,476,803; 1917, 19,887,147; and 1918, 20,835,254.

OATS ON RECLAIMED LAND

A CROP OF BARLEY

'Opportunity': The Anaconda Company's Farm for Employees

By OLIVER E. JAGER

On the human side of mining much has been written, but it is safe to say that the amount of discussion and theorizing is far in excess of the practical efforts put forward to improve the living conditions of employees at mines and smelters. That this statement is being gradually refuted is admitted, as practice is every year catching up with theory. It is therefore of interest to the profession in general, and to the large corporations in particular, to describe an actual accomplishment on a scale sufficiently large to demonstrate the practicability of the scheme and the value of the results obtained. It is unnecessary to enlarge on the value of the contented worker, the 'steady' man, although there are some managers who fail to realize the actual money loss of chronic 'hiring and firing'; nor need mention be made of the merits of good citizenship, especially in these days of unrest, doubt, and various 'isms' with names both foreign and domestic. Suffice it to say that any plan is meritorious whose fundamental principles tend to produce a general improvement in the conditions of life, to make a man a better citizen by giving him a stake in the community and a home of his own, and last, but not least, to provide means for the individual production of food by means of farming on small tracts. With these principles in view, and following its general policy of taking care of steady employees, the Anaconda Copper Mining Co. established a farming settlement known as Opportunity, situated in Deer Lodge valley, Montana, 7½ miles east of the city of Anaconda. Another motive for throwing open this area for settlement was the hope, to a certain extent, of relieving congestion in the city.

That many employees were desirous of settling on the land was demonstrated by the fact that the Farms Department of the company had been frequently approached with requests for small tracts of tillable land in the vicinity of the smelter, where gardens could be grown, chickens and hogs kept, and a cow maintained. This gave a clue to the size of holding desired, but before any settlement could be started, nearly three years were spent in preparing the land. The history of this period is interesting, because it gives an idea of the amount of work done by the company in overcoming the natural defects of this portion of Deer Lodge valley.

The character of the country immediately adjacent to Anaconda and to the works, on account of the fact that it was a boulder-wash unsuitable for agriculture, made it necessary to go some distance to secure an area of land adapted to the purpose. There was, immediately east of the smelter and reached by wagon-road from Anaconda, an area of several thousand acres that formerly, when the country was first settled, had been natural wild hay and meadow land. In consequence of the irrigation of the higher ground, these meadows had become a swamp, unsuited to agriculture and in several places such quagmires had formed that fences had been erected to save livestock from being lost. It was decided to acquire these areas, which were alluvial deposits, formed partly during old Glacial conditions, but principally by beaver-dam action and the consequent silting accompanying the labors of these industrious little builders.

The first problem was to drain the land, which, on account of the sloping nature of the country, called for a special system. Parallel lines of 12-in. tile, spaced 1000 to 1200 feet apart, were put in at a depth of from six to

seven feet, in order to secure a rapid and free movement of water from the surrounding beds of gravel. These 12-in. lines emptied either into open ditches or into 24-in. lines, and performed their work so well, that, within a few months after the installation of this drainage system, it was possible to enter upon these lands with heavy traction machinery and reclaim them.

On account of the peaty character of the ground—caused by its long-continued swampy condition—the usual agricultural machinery was inadequate for cultivation. It became necessary to develop a special type of machine, which consisted of a large rotating cylinder, armed with heavy teeth, capable of tearing up the peat and brush-roots, leaving them in such a condition that it was then possible to burn over the entire area and get rid of the excessive peat, alder and willow roots, and stumps. Two years of experimenting was necessary to develop a suitable type of rotary cultivator. The difficulty of breaking up the ground is best illustrated by referring to the power used in the operation, as it took three 60-hp. tractors to drag the machine, the power of the last tractor being employed mostly for rotating the toothed cylinder. The preparation of the ground for farming purposes was completed by modern tillage machinery, that is, by plows, discs, and harrows.

There was thus prepared about 1000 acres, which was divided into tracts of from 5 to 10 acres, though there are a few odd lots of 2½ acres. The standard tract of 10 acres is 435 ft. wide by 1000 ft. long, all tracts having a street in front and an alley in the rear. It may be stated at this point that should the settlement be expanded, there are several thousand acres of land available in the vicinity. A system of irrigation was provided whereby water was delivered in ditches owned by the company to the corner of the tract, and a contract was made for the perpetual supply of these lands with irrigating water on a basis similar to that followed in Government and private irrigation projects. Provision is also made to pump water from the tile-lines onto the land, should a series of dry seasons intervene.

The tracts were sold to employees of the company on a basis of 30 monthly installments with deferred payments at 6%, or for cash. Unlike a real-estate project, this scheme was not in any sense developed with the idea of profit, but rather to provide prospective home-owners with land at the approximate cost of purchase and improvement. The cost of purchasing, draining, breaking, and the withdrawal of approximately 10% of the area for streets, alleys, and park, made this land cost between $90 and $100 per acre. The land was sold at from $75 to $125 per acre, depending on location and desirability, and the company has had a small loss per acre over and above the returns from the sales. The Deer Lodge Valley Farms Co. is the name of the organization handling the land. It makes a contract with the purchaser for the conveyance of the property, subject to the usual restrictions contained in such instruments. The terms are in no sense hard; they are meant to be fair to the purchaser, and provide for preserving the improvements, good appearance, home-like character, and morality of the area. One clause in the contract provides that in case of the death of a purchaser before the completion of his payments, his wife or child will be given a clear title to the tract in question without further payment. There is no record of any purchaser losing his tract by default. The first lot was sold in 1913; by the end of 1916 the tracts were practically all occupied. Since the area was thrown open for settlement, the value of the land has increased by from 30 to 50%.

At first, the Farms Department of the company maintained teams, men, and equipment for doing a considerable part of the heavy work on these little tracts in connection with plowing, harrowing, sowing, and harvesting grain. About 90% of this work at the start was done by company men and equipment, but gradually, as the residents have purchased horses and farm-machinery themselves, and as certain individuals in the community have started to undertake this kind of work, it has been possible to eliminate almost entirely this service on the part of the company. A charge was made at the rates current in that part of the country. The land is suitable for raising oats, barley, and garden-truck, and some hay is grown for fodder. Cows, chickens, and rabbits are raised, the company providing a pasture for cows at a low rate.

With the idea of assisting the building of homes, lumber was furnished to the residents of Opportunity at mill-cost plus a small charge for handling. The cost of the homes erected varies from $1000 to $2000. Through the generosity and public-spiritedness of the Daly Bank & Trust Co. of Anaconda, arrangements have been made whereby, at a rate of interest considerably less than the current rate, funds have been loaned to tract-owners to assist in supplying the necessary money for buildings and improvements. No definite plan is followed in making these loans, each individual case being considered on its merits. The loans are re-paid on an installment basis, similar to the installment plan upon which land is purchased.

A plentiful supply of good water for household purposes is obtained by sinking a well to a depth varying from 4 to 20 ft. Some homes have been equipped with a small pumping and pressure set, so that water can be piped through the house in the usual way. Individual sewerage is installed with the usual septic tanks, which give no trouble. On account of the heavy flow of ground-water and the nature of the strata, there is no danger of contaminating the drinking-water. Coal-chutes and sheds have been installed, and coal and wood sold for the convenience of the community. At present about one hundred families have settled at Opportunity.

The company also arranged to have two or three small schools in the adjoining district abandoned, and at their own expense erected a modern school-building, supplanting these country-schools, thereby enabling the community to establish a graded school. Children from outlying districts are picked up daily by automobile or street-car, to be taken to and from school. About 120 children

ONE OF THE HOMES AT OPPORTUNITY

PLOUGHING WITH TRACTOR

are in attendance at the school, which is included in the Anaconda school-district and is under city supervision.

In addition to this, the company completed a street-car system from Anaconda to Opportunity, connecting with the line to the smelter, giving a service of 12 cars daily each way. This service is timed for the accommodation of men going to and returning from work, for people going to town to shop or to public entertainments in the evening, and for the convenience of the school. This car-service has been rendered for a flat rate of five cents, the School Board defraying the cost of children who have to come to school by street-car, and also that of the children from outside communities who come to the Opportunity school by automobile. There is a tri-weekly delivery from stores in Anaconda.

Home-builders in Opportunity are not confined to any one class of employee, but include all grades, from laborer to superintendent. An instance could be given where a man came in, figuratively with a $10 bill, and who now owns his own home and a tract of land worth $2000. It should be explained that not all the residents of Opportunity are cultivating their ground, or at least not to its full extent, some being content to regard their holding as a home in the country. The amount of produce obtained from a tract is directly proportional to the work done on it. One man will have 1000 chickens this summer. Others are keeping cows and making money selling cottage-cheese, while hogs are the principal product of other tracts. The man starting with a small capital builds himself a shack, and gets a pig or some chickens. He endeavors to raise enough crops on his land to feed his animals, and carry on in a small way, saving money, till he can increase his investment and enlarge his sphere of operations, as there is no difficulty in selling the farm produce. About this time a loan from the bank will enable him to replace the shack by a good house. Of course, it is not quite so simple as it appears, but it can be done if a man will work.

Running through the community there are three streams, and on either side of the banks a strip of from 30 to 50 ft. has been reserved in perpetuity for the benefit and enjoyment of the people. In addition to this, a 65-acre park tract has been permanently reserved, which, with the completion of the development will be approximately in its centre. There is a wooded mountain stream running through the entire length. The school-house has been erected in the park, and no single benefit that this community has bestowed upon its residents seems greater than the apparent happiness which this attractive little park confers on the children, who can be seen any noon, as soon as school is out, scampering to favorite nooks along the creek to eat their luncheon and play during the recess.

And so the human element comes in once more. Surely, a contented and healthy community, living under healthful conditions and bringing up families in clean surroundings, will produce better citizens than can possibly emerge from the squalid workmen's residential areas of the average mining and industrial centre, where verdure is absent and where the only crop is a prolific undergrowth of tin-cans and broken bottles.

The Anaconda Copper Mining Co., as the pioneer in this new departure, is to be congratulated on the success of the scheme. It has been largely experimental, but is working out to a successful issue. While it is not here advanced as a panacea for all labor troubles, it shows what can be done in settling the employee on the land near his work. I am indebted to H. C. Gardiner, manager of the Deer Lodge Valley Farms Co., and veterinarian in charge of the Anaconda Copper Mining Co.'s farm and ranch projects, for much of the information herein contained. He has been with the project since its inception, and has contributed, in no small degree, to its success.

Work of Alaska Road Commission

The total mileage on March 1, 1919, of roads and trails was 4830. Of this amount 2866 miles comprised a connected system reaching from Valdez and Chitina to Eagle, Fairbanks, places above the Arctic Circle, to the Lower Yukon, Nome, Candle, and other Seward Peninsula points. This system is joined at several points on the Yukon river by a second system of 2736 miles, which begins at Seward, and serves the Iditarod, Ophir, and Innoko districts. In addition to these two connected systems there are 288 miles of short roads and trails in various parts of the Territory. To March 1, 1919, the total amount expended for all maintenance and construction since January 1905 was $4,923,596; $2,355,700 has been spent for maintenance and construction of the Richardson road from Valdez and Chitina to Fairbanks, or approximately $5770 per mile on the 410 miles. During the past winter automobiles made the 120 miles from Chitina to Meiers in a day; from Meiers to Little Delta sleds were used; and from Little Delta to Fairbanks, 60 miles, autos have been making regular trips all winter. The bulk of the summer traffic on the Richardson road is handled by passenger and freighting automobiles. Although these machines do not make the trip with the same degree of comfort and ease that is possible on the State roads, which cost from $10,000 per mile and up, they do get through, and with favorable weather conditions the trip from Chitina to Fairbanks, 320 miles, is made in about twenty-four hours running time. When considering road work in this territory it is well to keep in mind the difference between Alaska costs and those obtaining outside. In normal times, outside, $5 will hire a team and driver one day, and the owner furnishes feed. On much of the Alaska work in the interior it costs $5 or more to feed one horse one day, and many other costs are in the same proportion. The Bureau of Public Roads and the Forestry Service have joined forces with the Alaska Road Commission to construct roads within the National Forests. The Territorial Legislature passed a progressive road law which provides machinery for the most efficient highway administration through co-operation with the Federal authorities.

REVIEW OF MINING

CALIFORNIA

NEW POWER COMPANY.—MINING IN SHASTA AND SIERRA COUNTIES.

NEVADA COUNTY.—The plans of intended construction and methods of serving the public by the Marysville and Nevada Power & Water Co. have been published. The work of securing water rights has been quietly proceeding for many months past under the supervision of Lars R. Jorgensen, an engineer of San Francisco. The company will enter the field in competition with the Pacific Gas & Electric Co. and the Great Western Power Co. to supply electric current in the fields now served by these two. Later ditches and laterals will be constructed to use the water for irrigation. The work in hand is being devoted to dam construction and securing water rights. The dam is under construction at Bullard's Bar by a San Francisco firm.

The State Water Commission has authorized the publication of the following:

Lars R. Jorgensen, San Francisco, applies for 275 cubic feet per second of the waters of the North Fork Yuba river, 25 cubic feet per second from middle fork of North Fork, and 50 cubic feet per second from north fork of North Fork Yuba river, Sierra county, tributary Yuba river, for power purposes. Diversion works consist of concrete arch dam 140 ft. high, 400 ft. long on top, and 100 ft. long on bottom, and two main canals 13 and 9 miles long, respectively. The application provides for the storage of 80,000 acre-feet. Construction work will begin on or before January, 1921, and be completed in January, 1924. The water will be returned to North Fork Yuba river after use. Estimated cost $4,000,000. (Allowed 6 months from May 13 to file maps). Lars R. Jorgensen, San Francisco, 400 cubic feet per second of the waters of the North Fork of the Yuba river, a tributary of the Yuba river, Sierra county, for power purposes. A concrete arch dam 85 ft. high, 200 ft. long on top, and 60 ft. long on bottom will be constructed to divert the water into a main conduit four miles long. Construction work will begin in January, 1921, and be completed in January, 1924. Estimated cost, $1,400,000. The water will be returned to North Fork of the Yuba river after use.

The Pacific Gas & Electric Co. has started extensive improvements upon Lake Van Norden, two miles west of Donner. The plan is to raise the dam 5 ft. and increase the storage capacity. G. C. Wintermute of Tacoma, Washington, has a bond on the Smethurst mine at Brown's Valley, 20 miles west of Grass Valley. The mine is being pumped out and several men are at work. The Smethurst was formerly a producer.

GRASS VALLEY.—J. F. O'Connor has applied to the State Water Commission for a permit to appropriate 500 cubic feet per second of the waters of Canyon creek and the South Yuba river, with storage of 125,000 acre-feet, for municipal and agricultural purposes. Site of proposed dam not given, but it will be 200 ft. high, 800 ft. long on top, and 400 ft. long on the bottom.

Notice is given of the closing of the charter of the Mine Workers Protective League on July 26.

SHASTA COUNTY.—The Bully Hill Mining Co. has raised wages 50c. per day all around. Miners will now get $4.50 per day and muckers $4. Board is $1 per day. The company employs 60 men. H. R. Hanley, designer and builder of the Mammoth Copper Co.'s zinc plant, has resigned and will go to another camp. Charles A. Hoffmaster, for 15 years purchasing agent for the company, has also resigned to go to the southern part of the State. The Victor Power & Mining Co. has taken over the bond given by E. P. Conner & Son on the Bull Moose mine, which closely adjoins the Victor's claims. The final purchase price is to be $20,000, and is payable in monthly

installments of $500. Two Gibson mills are kept running on ore from the Bull Moose and the Midas.

SIERRA COUNTY.—M. E. Beggs and associates have a crew of men clearing at the Kate Hardy quartz mine below Forrest City, preparatory to re-opening. The power line is being re-built and as soon as current is available underground work will commence. The old mine was rich and will be thoroughly prospected.

COLORADO

FURTHER DETAILS OF THE STATE MINES DEVELOPMENT ASSOCIATION.

DENVER. The result of the gradual decline of the mining industry in Colorado has been a progressive discontinuance of the support that is necessary normally to sustain public interest in mining ventures. About one year ago a few men who had become depressed by the mining situation conceived what is now incorporated as the State Mines Development Association. This is to be an association of persons who have sufficient vital interest in the mining industry to purchase shares of stock in an enterprise that will be pushed for the good of the mining industry without any selfish motives on the part of its promoters. It is believed that an association composed of cash-interested stockholders will do better and more efficient work, to the ultimate good of all concerned, than one in which membership would be gratis. A great amount of hard work was done by the men who conceived the project and the organization is finally assuming its intended function. No benefits will come to the promoters except through the success of legitimate mining undertakings which it is the object of the association to further. No stock has been or will be issued to anyone except for full cash at par value. All revenues thus far collected from the sale of stock have been used in defraying expenses of organization. No extravagant salaries are allowed to the few officials required nor are unusual expenses permitted. If the plans outlined by the organizers are carried through, the entire State will share in the ultimate results. It has not thus far been necessary to raise much capital, and hence no special effort has been made to place subscriptions beyond the needs of the preliminary stages of the project. In fact, up to July 19, no publicity has been given to the association and relatively few persons outside of the mining districts are aware of the movement. Since the mining districts of the State will be directly benefited by the successful outcome of this promotion, these districts were expected to and did enter heartily into the enterprise. To date very little has been said about the association in the cities, although it is presumed that, as plans proceed and the organization requires capital for its activities, business men and bankers throughout the State may wish to become identified with it. The purposes of the association are the development of the State's mining resources, the revival of abandoned mining camps, the exploration of new fields, and the operation of new as well as old properties. As a rule in the past most small mining promotions have been unable or unwilling to obtain proper technical advice. This association will retain the best engineers available.

The State has been divided into districts, each district organized separately but subsidiary to the parent association. Each subsidiary will recommend the expenditures of money in its vicinity, such recommendations being, however, referred to the central office in Denver for endorsement by the engineering and financing boards. Each district will retain one mining engineer, and the central office will have five engineers who are men of wide reputation. Before any property is acquired it must first be passed upon favorably by the local board of directors and its engineer, and their finding must then be accepted by the central board and engineers. Failures resulting from lack of legitimate engineering advice will thereby be practically eliminated. Seven district associations have been organized, covering the following mining sections of Colorado: (1) Ouray; (2) Silverton; (3) Eagle county; (4) Pitkin county and portion of northern Gunnison county; (5) Chaffee county and north-eastern portion of Gunnison county; (6) Clear Creek, Gilpin county, and north-eastern portion of Summit county; (7) Lake county, Park county, and balance of Summit county. It is proposed to reserve three districts at large for portions of the State that may hereafter come to the front in metal mining. Cripple Creek has not been districted, for the reason that it does not appear that activities have been relaxed there through lack of interest or exploration. The board of each district comprises a president who is usually a city or county official; a vice-president who is a mining man of reputation in his district; a secretary-treasurer who is an officer of a bank in the district; an attorney who is held favorably in his community; and the engineer. Each such district organization is in reality an exploration company. Its function is to decide upon the most promising properties for operation, to make careful examinations of such properties, and to report the findings to the central office. When ten districts have been organized and have performed their functions, there will be at least ten mines in the State under development or operation simultaneously by the parent association. There may be many more than ten. We know that a large proportion of the mining properties that are scientifically selected and operated prove successful. The association aims to eliminate risks insofar as it is humanly possible. Operations will be in diverse districts with different types of ores. The failure of a single venture cannot seriously injure the association as a whole. It is believed that when the association is far enough along to require capital wherewith to purchase desirable properties the money will be readily forthcoming. If money can be made in legitimate conservative mining, there is no reason to doubt the outcome of this co-operative enterprise. It should be stated that none of the organizers of the association has any opportunity to present his own properties for consideration and there are, therefore, no perquisites connected with holding an office. I am reliably informed that no con-

selection has been given to the exploitation of any particular mine or prospect. The acquisition of properties will be on the same conservative unprejudiced basis as that practised by large exploration companies generally and no mine or property will be considered unless it passes investigation and promises to make good.

NEVADA

GOLDFIELD, TONOPAH, TULE CANYON

GOLDFIELD.—The Florence Divide lease on the Florence Goldfield has ready for shipment ore estimated to be worth from $128,000 to $160,000, the difference in estimates being due to the tenor assigned to the highest grade ore. The ore contains some of the best specimens of high-grade gold ore mined in the history of Goldfield. The vein being mined has a seam of ore on each wall, the rich material, varying in width from one to three feet, being on the foot-wall. On the hanging wall is a seam assaying from $50 to $75 and with a high copper content. The gold vein has been opened for a length of 138 ft., the occurrence of the rich ore being erratic. A small stope has been carried for 30 ft. above the 380-ft. level, the remainder of the ore for shipment being secured in development. Twenty men are employed on two shifts, and it is planned to employ another shift in a short time. The lease expires January 1, 1920.

The Goldfield Development Company on July 24 broke 6000 tons of ore assaying $23.80 in the Red Top. The blast required 350 lb. of dynamite, which was placed in a small drift after the ground had been loosened by small charges placed in six-foot drill holes. The ore is being broken into the old Red Top glory hole from a block 300 ft. long, 60 ft. wide, and extending from the 165-ft. level to the surface. Raising to tap the broken material has commenced. September 1 is the earliest date now fixed for starting the plant, the delay being due to the poor condition in which it was found and the difficulty in securing delivery of machinery. Boulders of gold ore have been found in the drag from a fault at a depth of 910 ft. in the Merger. The discovery was made in a 200-ft. drift on the shale-latite contact. The drift was driven from the 60-ft. west cross-cut from the 910-ft. level of the Spearhead shaft, through which all work in the Merger is being done. Near the fault and in the latite a seam of lead-zinc ore was found, something that is rare in the Goldfield district. Lead and zinc were found in the latite before the rich orebody was found on the contact in the Jumbo Extension. J. W. Dunfee of Goldfield, lessee of the Orleans mine at Hornsilver, will resume work in August from the bottom of the 600-ft. shaft. This lease has a production record of $260,000 gross, most of the ore being extracted on the 200 and 350-ft. levels. Four carloads of ore have been shipped during the past two weeks from the Nalaskowski lease on the Silver King.

TONOPAH.—The south-east drift on the fifth level of the Tonopah Divide has been driven 80 ft. The face is in rich ore, but assay figures have not been announced by the management. The main cross-cut has reached the foot-wall, proving the vein to be 35 ft. wide. The south-east drift on the fourth level is 430 ft. long and the face is in ore; the north-west drift on this level is 200 ft. long, but for the past 20 ft. low assays have been obtained. Three hundred feet from the main cross-cut on the third level a cross-cut in the silver vein is to be extended to cut the gold vein. The south-east drift on the second level is 375 ft. long, with the face in high-grade ore. A raise is to be started from this level and if it proves a continuation of the rich ore opened 245 ft. south-east of the main cross-cuts on the second, third, and fourth levels, the 60-ft. south-east drift on the first, or 165-ft. level, will be extended to connect with it. Sinking of the shaft below the fifth level will not be resumed until the lateral work on this level has been well advanced. The Brougher is cross-cutting east on the 177-ft. level to reach the extension of the Divide Ex. vein; a drift is also being driven south-east on this level. The south-east drift on the 500-ft. level is 400 ft. long and the north-west drift on this level is 300 ft. long. The raise in the south-east level has been stopped at a height of 75 ft. because of the unsatisfactory results obtained, together with poor air. A cross-cut from the 300-ft., or bottom level, of the Revert has entered the vein 60 ft. from the shaft, exposing 28 in. of $38 ore. A drift has been started east. The shaft of the Victory is 145 ft. deep. The plan of the management to cross-cut at 150 ft. has been changed and it is believed the shaft will be sunk an additional 50 ft. before lateral work is started. Three drifts are being driven on the 400-ft. level of the East Divide, one to prospect the main vein and two to develop a cross-vein opened in the cross-cut from the shaft. The south-east drift, being driven toward the intersection of the veins in which the Hennessy and Alto are sinking, entered a rhyolite dike and has been turned west to follow the vein.

TULE CANYON.—A. I. D'Arcy, consulting engineer for the Tonopah Divide, has taken an option on the Benton-Radford-Smith claims in the Tule canyon placer field and has started development work. Mr. D'Arcy has formed an association of 20 men with a capital of $40,000 to develop the claims by drift mining. The Goldfield-Tule Canyon Placer Mining Co., owning adjoining claims on the south, will soon start driving from a cross-cut driven to the centre of the canyon on bedrock.

ONTARIO

CASSEL CYANIDE CO. FORM CANADIAN BRANCH.

Official information has just been received that the Cassel Cyanide Co., of Glasgow, Scotland, has, on the recommendation of William Neill, managing-director, decided to incorporate a subsidiary company in Ontario to be called the Cassel Cyanide Co. of Canada. Mr. Neill has just reached Scotland after having completed one of his periodical tours of Canada and Mexico and was so favorably impressed with the splendid mineral resources of Northern Ontario, as well as with the opportunity that exists for industrial development throughout the Dominion, that he most strongly recommended his co-directors

to give this country an especial amount of their business attention. The object of incorporating a subsidiary company in Canada is primarily to bring the parent organization into more direct touch with the requirements of Canadian mining interests, but the further outlook is along the lines of general metallurgical and allied industrial development. Three members of the Glasgow board will be on the directorate of the Canadian company. All are highly successful business men, each being a specialist in the section of the organization to which he has given a life-long study. William Neill, the managing-director of the Glasgow company, will discharge similar duties in Canada and will be more frequently on this side of the Atlantic than formerly. He has been associated with cyaniding since John S. MacArthur, the original managing-director of the Cassel company, invented and developed the cyanide process. Sir George Beilby is the inventor of the process for manufacturing cyanide which the Cassell company adopted 27 years ago. During the War he patriotically devoted much of his energy toward developing methods of extracting oil from coal, so as to render the British navy less dependent on foreign countries for the fuelling of oil-burning high-speed naval vessels. In recognition of his many discoveries and of his scientific attainments he received, two years ago, the honor of knighthood. Sir George has devoted much of his spare time to the study of radium, especially in its metallurgical extraction and in its application to the treatment of diseases. He is president of the British Radium Institute. Sir Edward Allen Brotherton, another director, is a chemical manufacturer and the private owner of many large acid plants in various parts of England. His specialty lies along the lines of saving waste by-products and turning them to profitable account. He has several times been Lord Mayor of Leeds, and, at the commencement of the War, raised and equipped the regiment of which he is honorary Colonel. He was created a baronet slightly more than six months ago. One unique feature in the operating of the parent company as regards gold and silver mining has been the acquiring of interests in properties of potential merit and of helping mines which may be unable to reach the profit-earning basis because they lack a treatment plant. W. E. Simpson, who joined the original Cassel company 24 years ago, has, during the past seven years, attended to this part of the company's affairs from the practical standpoint and has spent much of his time in examining properties and, where necessary, of installing the plants. Canada welcomes the arrival of the organization, and, for many reasons, especially in the interests of its own development, heartily wishes the Cassel Cyanide Co. of Canada, Limited, every success.

ALBERTA

CALGARY.—Considerable alarm has been caused by the announcement that the Bow Island gas-fields are showing signs of exhaustion, and that a quarter of the consumers may have to be cut off from the supply. In the meantime the gas company is pushing boring operations in the Barnwell gas-field, in the hope of making a strike, and thus relieving the situation and preventing the use of such drastic measures, but, up to now, only one well has been brought in. The Bow Island gas-field supplies the city of Calgary and a large surrounding district with natural gas, which is used for both lighting and heating.

BRITISH COLUMBIA

GRANBY PRODUCTION. PETITION FOR RAILROAD TO THE GROUNDHOG COAL AREA.

For the year ended June 30 the Granby Consolidated Mining, Smelting & Power Co. produced 25,000,000 lb. of copper. This is a falling off of 20,000,000 lb., and may be attributed to the gradual closing of the Phoenix mines, the fire in the converter house at Anyox, and the tendency to curtail production owing to the low price of copper after the signing of the armistice. The company has taken an option on the Harrison properties on Chickamin mountain, between Eutsuk and Whitesail lakes. The price is understood to be $200,000, payable over five years. The Rambler-Cariboo company, of Three Forks, has bought the adjoining claim for $75,000. The orebody from which the Rambler company took ore to the value of $2,000,000 runs through the newly acquired area for 1600 ft. The Blue Bird and Rawdon claims on Reco mountain, near Sandon, have been purchased by Clarence Cunningham and Sidney Norman for $35,000, payable over three years. The Rocher De Boule mine, at Tramville, has closed down. A quantity of milling ore has been developed underground and there is a considerable amount on the dumps, but there is no mill on the property, and only ore from the rich shoots that occur from time to time has been shipped. The developed shoots have been exhausted, hence the closing. The Silversmith mine, at Sandon, shipped four cars of silver-lead concentrate in June. The orebody is being developed in the upper levels, and is looking remarkably well. The Skeena Mining & Milling Co. has been incorporated with a capital of $250,000 to take over the Coronado and Victory properties in the Hazelton district.

PRINCE RUPERT.—A petition is in circulation requesting the Provincial Government to offer substantial inducements for the construction of a railroad connecting the Grand Trunk Pacific with the Groundhog coal areas and for the development of the coal areas. Immediately before the War, the late Lord Rhondda had a plan for this work in hand, which was backed by British capital, but with his death the whole thing collapsed. It is estimated that the road will cost $15,000,000, and it is suggested that the Government should offer 10,000 acres per mile, together with the right to explore and exploit 250,000 acres of coal areas on the usual conditions laid down by the mining laws of the province. At the present time Prince Rupert people are paying $16 per ton for coal, which is brought from Vancouver island, and it is with the view of obtaining relief from this burden that the petition is being circulated.

ALASKA

Anchorage.—Tellurides of gold have been discovered in ore from the Gold Cord mine in the Willow Creek district. The species were not identified, but calaverite and nagyagite are indicated. The discovery was made by F. Le Roi Thurmond.——R. I. Sill of Los Angeles is examining the Alaska Free Gold, Gold Cord, and other mines and prospects for Los Angeles people who contemplate extensive investments in the district.——The Le Roi mine has let a contract for the driving of 250 ft. of adit to develop a strong vein outcropping on this property.——A U. S. Geological Survey party—R. M. Overbeck, geologist, J. R. Eakin, topographer, and William Foran, assistant—have gone into the Broad Pass region to finish a reconnaissance begun last year.—— Four million dollars has been appropriated by Congress for the Alaskan Engineering Commission for the fiscal year 1919-1920. This is a reduction from twelve million requested. The Commission plans to lay steel to Indian river this season.

ARIZONA

Chloride.—The Diana mine, 1½ miles west of Chloride, has been taken over by a security corporation of Boston. Extensive development has been planned and work is to commence before August 1.

Douglas.—The Calumet & Arizona Copper Co.'s smelter output of blister copper for the month of June amounted to 4,924,000 lb., which was an increase of more than half a million pounds over the May production.

Mayer.—The Big Ledge Development Co. is reported to have taken over the Good Luck group of six claims for a consideration of $30,000.

Miami.—Thirty-six claims of the North Dominion Copper Mining & Development Co. are advertised to be sold at a sheriff's sale to cover the judgment of $2405 obtained against the company by W. H. Mercer. Since the signing of the Armistice, the Van Dyke Copper Co. has been preparing to sink a shaft and prove the 40 ft. of high-grade copper ore found in the No. 1 drill-hole at the 1220-ft. level. Sinking started May 12 and is progressing rapidly. The shaft, which is now down 200 ft., is about 800 ft. from present Inspiration Copper Co.'s workings.

Oatman.—The strike recently made at the Tom Reed mine near the Telluride property is said to have opened a new vein. Considerable driving has been done on this vein, proving it to be nine feet wide in places and assaying $17 in gold.

Patagonia.—A. Hennessy is developing a silver property in Corrol canyon. Good bodies of ore have been opened in the Republic No. 1 and 2 and in the Soldiers shaft which is down 40 ft. Preparations are being made for the first carload shipment.

Phoenix.—The total assessed value of the mining properties of the State of Arizona has been placed at $463,184,526, of which amount $417,707,615 represents the valuation placed upon the producing mines. The Inspiration Consolidated Copper Co. leads the list of large producers with a valuation of $79,900,000. The Phelps Dodge Corporation, Copper Queen Branch, is second with $72,050,407. Others in order of importance are: United Verde Copper Co., $50,273,766; Ray Consolidated Copper Co., $48,504,837; United Verde Extension Copper Co., $42,379,713; Miami Copper Co., $30,803,654; New Cornelia Copper Co., $29,555,984; Old Dominion Copper Co., $15,129,208; Phelps Dodge, Morenci Branch, $8,414,471; United Eastern Mining Co., $5,442,065; Magma Copper Co., $5,168,339; Shattuck Arizona Copper Co., $4,963,522; Consolidated Arizona Smelting Co., $4,153,842; Arizona Commercial Mining Co., $2,498,757; and Tom Reed Gold Mining Co., $1,412,801.

Prescott.—The Tuscumbia silver mine in the Bradshaw mountains five miles west of Peck is being sampled and examined by engineers representing a large mining syndicate. The Pat Dolan group of two claims has been sold to the Peck Mining Company for $30,000. Operations on these claims are to be commenced at once. The old workings of the Peck mine are being explored and the new mill is now treating the 30,000 tons of old tailing.

Superior.—Development work has been started on the United Superior Copper Co.'s claims which adjoin the property of the Grand Pacific. E. C. Norris is in charge of the work.

Tucson.—Albert Steinfeld & Co. has brought suit against the Narragansett Mines Co. to recover $300,000 loaned on notes. The Narragansett mine is one of the oldest producers in the Helvetia mining district. This property has been worked periodically since 1870 and has yielded a large tonnage of high-grade copper ore in the past.

CALIFORNIA

Grass Valley.—Mining conditions are rapidly becoming normal in the Grass Valley district, and the Empire and North Star mills are again operating at capacity. Water, which accumulated during the brief strike of the miners, is being rapidly removed from the deeper workings. The Sultana management is arranging to install new equipment preliminary to unwatering the property and resuming developments.——At the Idaho-Maryland a powerful compressor is being placed in commission and unwatering of the old shaft is about to commence. Several carloads of machinery for the new pumping plant have arrived.——New outcroppings from one of the lodes of the State Highway Mining Co., on the Morandi tract, have been found and disclosed some handsome specimens of ribbon quartz showing gold. The company now has its shaft down 50 ft. and has driven more than 100 ft. in search of the second lode known to exist in that locality. It is expected that this lode will be cut within a short time.

Kennett.—From 1905 to January 1, 1919, the Mammoth smelter at Kennett treated 3,420,410 tons of ore from the mine, according to the report of the advisory committee appointed by the supervisors to determine the assessed value of the company's property. The company was assessed for its mines and improvements almost $2,000,000 and asked for a heavy reduction. The committee finds that ore-reserves in the Mammoth now total only 115,564 tons, which with 17.9c. copper nets $3.83 per ton, a total of $442,610. The committee also found that the smelter can be kept running for a great period only after the company has spent

considerable money on development and on remodeling its reduction plant.

Lewiston.—The work of driving a new adit at the old Fairview mine, ten miles from Minersville, is going ahead satisfactorily to the new owners, a company of business men. Two shifts are working. The adit will tap the old workings at a distance of 800 ft. from the portal. A ten-stamp mill is on the property.

Sierra County.—The U-No and Favorite claims, believed to be an extension of the Tightner vein, were bonded recently to Alfred Van de Zande, Thomas Maher, and L. E. Hendricks, who will commence development immediately.

Weaverville.—The Superior Court has given the administrator of the estates of Henry Jacob and John Jacob, brothers, permission to sell their placer mines, which are on Trinity river across from Junction City, to Jafet Lindeberg, the Alaska mining man, for $21,000.

IDAHO

Kellogg.—The Caledonia Mining Co. has declared a monthly dividend of $26,050, according to Stanly A. Easton, president. This is at the rate of a cent a share on the issue of 2,605,000 shares. Payment will be made August 5. The forthcoming payment will increase the total of payments for the year to $208,400 and the grand total to $3,881,450. Figures covering the net profits in June have not been compiled, but Mr. Easton estimates them at $20,000.——Wages of miners in the Coeur d'Alene have been raised to the war scale of $5.25 per day. All the companies have agreed to the new schedule, which took effect from July 16, the last pay-day.——The installation of milling machinery and the erection of a covering for it is proceeding steadily on the property of the Nabob Consolidated Mining Co. It is believed the work will be completed in August. Stopes have been opened and underground work is proceeding. The plant will have a daily capacity of 150 tons and has been designed to concentrate the ore developed in the Denver claim of the company and in the original Nabob group. Ore has been followed on two levels of the Denver for about 400 ft. on each. The levels are 100 ft. apart and the lower attains a depth of 700 ft. at the face. The ore lies in parallel bodies a few feet apart. It contains an average of about 10% lead and 16% zinc, according to reports made in the period of development, about a year ago.

Mullan.—Operations in the Morning mine of the Federal Mining & Smelting Co. have been interrupted by a flow of gas. Whether the gas comes from an old fire or a new one has not been determined. Men remain in the mine but two hours to a shift to maintain the operation of pumps.——The National Copper Mining Co. earned $25,000 net in June, according to an official estimate. An improvement in grade has been found in the opening of a stope on the new 800-ft. level.

Salmon City.—Satisfactory progress is being made at the Pope-Shenon mill and mine near Salmon City, according to A. Bolais, superintendent. The forms for the foundation of the new mill are ready for the pouring of cement. The first unit, which will cost approximately $50,000, will be constructed with funds provided by the floating of a special bond issue. Work at the mine, which was retarded because of a lack of power, will be speeded up materially with the installation of a new gasoline engine, which was recently shipped.

KANSAS

Pittsburg.—All the mines of the Central Coal & Coke Co. in the Kansas field are idle. The strike order issued by President Alexander Howat and the district board of District No. 14, United Mine Workers of America, in conjunction with a similar order issued by the Missouri district officials, recently went into effect. Not only are all the Central's mines, employing about 1400 men, idle, but several mines owned by the Central and operated by other persons under lease are also affected. The miners allege that they have been unable to settle numerous grievances with the Central in the two States.

MONTANA

Butte.—A decision of more than ordinary interest to the mining men of the Butte district in particular, and also applicable to any other mining district where similar issues are involved, was received from the Interior Department recently by Attorney John A. Shelton, in the case involving the W. E. lode mining claim, lying in the south-eastern part of the Butte district in a valuable section of the copper area. Notwithstanding the fact that patent had been issued for the Emery placer in 1881, and the fact also that the mineral location contesting the placer right to the lode claim was not made until 1908-'9, it is held that the placer patent excepted from its provisions any rights as to the lodes known to exist within the ground claimed as placer. The Secretary of the Interior ordered the issuance of patent to the lode claimants for that part of the lode within the area covered by the placer patent. The importance of the decision rests in the fact that the Interior Department will permit the patenting of lode claims within the area of placer patents, already issued, if proof is furnished of the knowledge of the existence of lode-veins on the ground prior to the date of the application for placer patent, it being held that a placer patent will except from its grant any lode-veins so known and proved. The ground covered by the decision of the Reno company contest, while small, covers a valuable portion of the copper territory of the camp, lying in part across the Belmont group of the Anaconda company, and is known to be within the productive copper area.

East Butte produced 1,513,360 lb. of copper and 55,999 oz. of silver in June 1919, compared with 1,416,460 lb. of copper and 19,867 oz. of silver in May.

NEVADA

Carson City.—Governor E. D. Boyle has selected Messrs. Boardman and Jones, professors at the University of Nevada, to make a thorough investigation preliminary to appointment of commissions to establish a State smelter and State cement plant. The commissions are to determine the feasibility of erecting such plants, following the preliminary examination of sites, resources, and other factors. Appointment of the commission was authorized by the last Legislature. The proposed plants are planned to make the State independent of any cement trust and to encourage small mining companies.

Ely.—Diamond-drilling is proving the existence of extensive deposits of ore on the property of the Consolidated Mines Co., according to the report of Robert Linton, managing director: "An inclined diamond-drill hole has been put down on the 1300-ft. level to explore the formation in advance of sinking the shaft and opening up the mine to deeper levels. The drill at a depth of 1550 ft. below the collar passed through 33 ft. of ore, corresponding to a horizontal width of at least 16½ ft. and averaging 8% copper. New ore also has been recently cut on the 1300-ft. level, on the cross-cut farthest east on this level, and near the western end of the workings on the 1100-ft. level. This ore, which assayed 8% over 5 ft., is considerably south of any previously cut on this level. Satisfactory progress is being made on the cross-cut on the 1400-ft. level, which has, however, not yet reached the ore-bearing zone. A station is now being cut on the 1400-ft. level and shaft-sinking will be started as soon as possible. It has been decided to sink the shaft at once an additional 400 ft., which will permit of opening the mine to the 1800-ft. level."

Tonopah. Except at the Tonopah Divide and a half score other properties of early day standing, mining operations at Divide are largely confined to shaft-sinking. It is therefore not to be expected that ore discoveries will be numerous until depth is gained and the veins cross-cut and explored. ——Cross-cutting will soon be started at 100 ft. by the Crown Divide, adjoining the Belcher and Belcher Extension. This cross-cut will be extended under old stopes from which rich ore was shipped by a former management. The Crown is now using air-drills.——The shaft of the Alto Divide is 280 ft. deep and is cutting a different rock, indicating that the ore-bearing formation should be entered at about 300 feet.

Virginia City.—The orebody recently discovered on the Southwest Comstock has widened to five feet of ore, and the vein is increasing in size and richness as developments advance. The Southwest Comstock lies seven miles southwest of Virginia City, and is believed to be on the continuation of the Comstock lode. The Comstock Superior has started work on adjoining ground toward the north-east in expectation of opening ore at shallow depth. The Comstock Eagle Co. has acquired extensive holdings farther northeast and has arranged for aggressive work. Scores of claims have been located in the last month. The trend of the main vein system has been traced into Virginia City, and local men believe from the surface indications that the district is the true extension of the great Comstock lode, which has produced from $800,000,000 to $1,000,000,000 in silver and gold.

OKLAHOMA

Commerce.—The Defender Lead & Zinc Co. is preparing for a mill on its lease near the Bluebird between Tar River and Commerce. The company has a shaft in ore and a drift 200 ft. long, with one of the richest dumps in that part of the district. J. H. Wright, president of the company, expects to close a deal for a mill some day this week, and as soon as this is done work on removal will start. By the time the mill is ready it is planned to have the ground thoroughly developed, so that sufficient ore may be had to keep the mill in constant operation. A. G. Hoppock, of Joplin, is vice-president of the company, and H. W. Hess, of Baxter Springs, secretary and treasurer.——H. W. Hess together with nine associates have taken a lease on 40 acres of land formerly held by the Roanoke Mining Co. adjoining the Defender property. The Roanoke company failed to find an orebody, and abandoned the property. Mr. Hess and his associates were encouraged to take over the lease by the showing made by the Defender. They plan to drill eight or ten holes to a depth of 300 feet.

UTAH

The expected increase in wages in many of the districts became effective on July 16.

Notice of an increase of 75c. per day was posted recently at the Park City and Tintic mines. In the future the following scale for the various classes of mine labor will be paid: Machine man, $5.25; helper, $5; miner, $5; mucker, $4.75; laborer, $4; timberman, $5.25; helper, $5; cage-rider, $5.25; donkey engineer, $5; first-motion hoisting engineer, $5.50; second-motion hoisting engineer, $5; machinist, $5. Increases of wages of all men employed at the Bingham mines has been agreed to by the principal mining companies. Notices were posted at the properties of the Utah Copper Company at Bingham and Garfield that the amount of the advance would be announced within a week. Mines agreeing to an increase in the Bingham district include United States Mining Co., Utah Consolidated, Utah Metal & Tunnel, and the Bingham Mines Co. The action taken at Tintic and Park City of increasing wages 75c. per day re-establishes the maximum war-time scale of July 1918, when operations were curtailed fully 50% in consequence of the destructive slump in metal prices. Operators are said to feel that this increase has been granted in anticipation of improved metal market conditions and in recognition of the fact that the cost of living remains as high as during the War. If the near future expectations with regard to metal prices are not realized it is probable that some properties will suspend operations, inasmuch as many were not meeting operating expenses under the scale prevailing before the present increase. Statistics recently compiled and published show that Utah metal mine dividends in the first half of the year were 43% less than in the corresponding period of last year. State and federal taxes, which are an important item in the operation of the larger properties, are much higher than last year. This consideration alone more than offsets the moderate reductions made in a few lines of mine supplies since the first of the year. Moreover, quotations on all principal Utah metals, with the exception of silver, which is about five points higher, are well below the prices prevailing last July, when the equivalent of the present new scale was established.

Alta.—Developments in the Alta Tunnel are reported to be of a highly interesting character. The big adit is now in 3600 ft., from which point drifts are being driven in different directions to get into the ore-zone. The drift to the south-east has been pushed a distance of 400 ft. Just now there is considerable water coming in, a condition which indicates open country beyond and is regarded as a hopeful sign. The Tunnel workings have a vertical depth of approximately 1600 ft., which is practically 800 ft. below the workings of the Prince of Wales. For nearly 200 ft. the miners have been driving west on a fissure following small stringers of ore which run under the lime. Although company officals claim nothing of a sensational character, they are much encouraged with the outlook and propose to continue the work.

Tintic.—Tintic ore shipments for the past week show an excellent increase. The mines and the number of cars of ore shipped from each follow: Chief Consolidated, 25; Dragon, 19; Tintic Standard, 16; Iron Blossom, 15; Centennial-Eureka, 9; Grand Central, 8; Mammoth, 7; Colorado, 6; Eagle & Blue Bell, 6; Empire Mines, 4; Swansea, 4; Ridge & Valley, 3; Gemini, 2; Bullion Beck, 1; Victoria, 1; Alaska, 1; Showers, 1; George Castleton, 1; total, 129 cars.

WASHINGTON

Republic.—"The Quilp Gold Mining Co. has sunk to 800 ft. in its extension of the Surprise shaft and in the course of this work has removed nothing but ore," said W. W. Gifford, secretary of the Alliance Mining Co. "Ore in a large body has been followed within Quilp ground for 200 ft. on the 800-ft. level. The Surprise shaft is on adjacent property and has reached a point 15 ft. from an end-line of the Quilp. Everything broken in the course of this development has been shipped to the smelter. These disclosures have encouraged the company to unwater and extend the Quilp shaft with a view to connecting with the drift in ore on the 800-ft. level." W. G. C. Lanskall is manager, Alex McKay, superintendent, and S. H. Richardson is the consulting engineer.

Spokane.—Coal of high grade is reported by recent visitors to the Detillion coal mine about 40 miles down the Spokane river from the city of Spokane. The property is owned by B. F. Tilsley, Phil Hoisington, and associates, all of Spokane, and is being developed by Hoisington, Tilsley, W. C. Corbett, and others who were in the inspection party. ——The Loon Lake Copper Co., whose property is about 50 miles from Spokane, has had two shifts at work in the mine for a week. The mill is being operated on a two-shift basis or at the rate of 100 tons daily.

CANADA

British Columbia

Grand Forks.—The Grand Forks smelter of the Granby Consolidated Mining, Smelting & Power Co. may be reopened should be price of copper rise to a point in the neighborhood of 25c. per pound, says a Boston report. Operation of the smelter was suspended recently after a service of two decades or longer.

Trail.—James J. Warren has been made president of the Consolidated Mining & Smelting Co. of Canada. For two years he has been managing director of the company. The offices of the company are to be moved from Toronto to Montreal. The company received 7205 tons of ore in the seven days ending July 17, according to a report from its smelter at Trail, B. C. The figures differ little from those of the last previous week, but are above the average in previous months.

Ontario

Grenfell Township.—A gold discovery of considerable promise has been made on the Four Nations Gold Claim, situated a mile or two north-west from Kenogami station, in the township of Grenfell. The vein in which the gold has been discovered has been traced for about three hundred feet, being found at outcrop on both sides of the Blanch river. Considerable exploration work has been done this year by the owners of the property.

Kirkland Lake.—According to the rate of progress on the construction of the macadam road from Swastika to the centre of activity in the Kirkland Lake district, it appears that the new road will be completed before winter. This road is expected to result in a substantial reduction in the cost of material at the mines, as well as in the town of Kirkland Lake.——In connection with the Canadian-Kirkland mine, which is under option to the Crown Reserve Mining Co. of Cobalt, it is learned that the option agreement contains a strike clause which has the effect of suspending the terms of the duration of the strike. Some of the working options held by other companies in the Kirkland Lake area do not contain a strike clause and are consequently inconvenienced by the present labor strike.

Porcupine.—Dome Lake's mining plant, which was damaged by the recent forest fires, will probably be in operation when this goes to press. It was found that the fire did much less damage to the plant than was at first thought. The boilers were not damaged to any extent and some small repairs only were necessary to put the compressor in working order. Two motors, which were burnt out, have been replaced. The greatest loss occurred through the destruction of the buildings.

MEXICO

The U. S. Department of State recently made public portions of the new Mexican mining law that went into effect July 1. The transitory articles provide that all penalties due on mining properties prior to the date of the decree, June 27, 1919, are cancelled, but that taxes on mining claims must be paid during July and August of this year. Provisions are made for the payment in installments of the taxes overdue, but, if the new law is not complied with, the titles to the properties will revert to the State. The new decree also prohibits the export of gold and provides that if bars of mixed minerals which include gold are exported coinable gold must be shipped into the country in quantity equivalent to the gold contained in the mixed bars. The tax rate applied to the mining industry is graduated so that the larger the property the heavier the tax.

KOREA

Unsan.—The Oriental Consolidated Mining Co. extracted $84,820 worth of gold in June.

PERSONAL

Note.—The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

Waldemar Lindgren is here.

L. B. Jarvis has returned from the Malay States.

C. H. Munro is at Ipoh in the Federated Malay States.

C. Colcock Jones, of Los Angeles, was in San Francisco this week.

Edwin Higgins has returned to San Francisco from a visit to Ajo, Arizona.

Henry P. Nagel, Jr., of Denver, has been visiting Tuolumne county mines.

Bennett R. Bates will be in Mexico for several months representing the Dorr Company.

Adolf Knopf, of the U. S. Geological Survey, has been inspecting the Divide district of Nevada.

C. W. Beauchamp, for thirteen months with the Engineer Corps of the A. E. F., has returned to Worden, Illinois.

Donald M. Liddell, Captain in the A. E. F., has resumed his work as chemical engineer at 66 Broadway, New York.

L. F. S. Holland will return to California early in August from Bingham Canyon, Utah, where he is making examinations.

Henry F. Collins is now living in London; he has been elected a member of the Council of the Institution of Mining and Metallurgy.

Ernest Levy has left Rossland, B. C., to go to Havana, Cuba, to take charge of some properties for Alexander Hill & Stewart, of London.

Lester S. Grant, formerly superintendent of the Jumper mine, in California, has been appointed Professor of Mining in the Colorado School of Mines.

Harry J. Wolf, Professor of Mining in the Colorado School of Mines, has resigned in order to join the editorial staff of the 'Engineering & Mining Journal' at New York.

Sidney R. Stanford sailed on August 1 for Central America, where he will have charge of the mine belonging to the Constancia Consolidated Mines, at Bluefields, Nicaragua.

Charles W. Badgley is now superintendent of the El Paso smelter, succeeding **James Heggie**, who has become superintendent for the United Verde Extension Copper Co., at Jerome, Arizona.

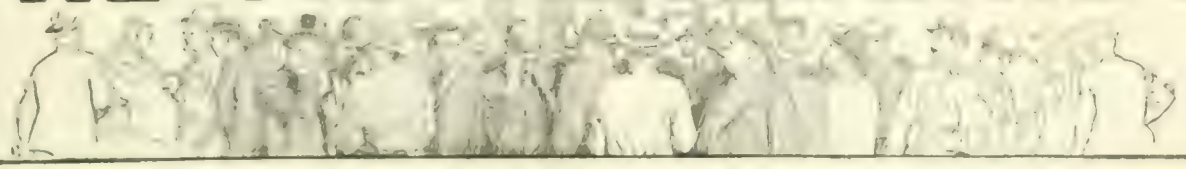
C. H. Abeling has resigned as mill superintendent of the Quad-Metals mill at Frisco, Utah, to accept the position of construction superintendent for the Vipont Silver Mining Co. near Oakley, Idaho.

Clarence K. Colvin, of Los Angeles, has returned recently from Sonora, Mexico, and visited San Francisco this week, to meet his son, Lieutenant Harold B. Colvin, on his discharge from the A. E. F.

Edgar Rickard, who is now resident in New York, has been appointed acting chairman of the American Relief Administration European Children's Relief until the return of Mr. Hoover, when he will remain a director of this charitable organization.

James S. Colbath, recently from the Philippine Islands, where he was in charge of the property of the Colorado Mining Co. at Aroroy, Masbate, has become general manager for the Dolores-Esperanza Corporation, with offices at 714 Mills Bdg., El Paso, Texas.

THE METAL MARKET



METAL PRICES

San Francisco July 29

Aluminum dust, cents per pound	50—60
Antimony, cents per pound	9 50
Copper, electrolytic, cents per pound	23 50
Lead, pig, cents per pound	7 75
Platinum, nuts per ounce	$105
Platinum, 10% iridium, per ounce	$121
Quicksilver, per flask of 75 lb	$105
Spelter, cents per pound	9 75
Zinc dust, cents per pound	11 00—13 50

EASTERN METAL MARKET

(By wire from New York)

July 29.—Copper is active and firm. Lead is steady and higher. Spelter is less active but easy.

SILVER

Below are given official or ticker quotations, in cents per ounce of silver 999 fine. From April 23, 1918, the United States government paid $1 per ounce for all silver purchased by it, fixing a maximum of $1.01½ on August 15, 1918, and will continue to pay $1 until the quantity specified under the Act is purchased, probably extending over several years. On May 5, 1919, all restrictions on the metal were removed, resulting in fluctuations. During the restricted period, the British government fixed the maximum price five times, the last being on March 25, 1919, on account of the low rate of sterling exchange, but removed all restrictions on May 10. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the normal rate of exchange.

Date	New York cents	London pence	Average week ending	Cents	Pence
July 23	104.25	54.56	June 17	111.98	54.48
" 24	106.50	54.87	" 24	111.52	54.40
" 25	107.25	55.06	July 1	108.83	53.48
" 26	107.75	55.06	" 8	107.52	53.47
" 27 Sunday			" 15	106.35	53.38
" 28	106.50	55.18	" 22	104.85	54.25
" 29	107.00	55.25	" 29	106.54	54.99

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	75.14	88.72	101.12	July	78.92	99.62	....
Feb.	77.54	85.79	101.12	Aug.	85.40	100.31	....
Mch.	74.13	88.11	101.12	Sept.	100.73	101.12	....
Apr.	72.51	95.35	101.12	Oct.	87.38	101.12	....
May	74.61	99.50	107.23	Nov.	85.97	101.12	....
June	76.44	99.50	110.50	Dec.	85.97	101.12	....

COPPER

Prices of electrolytic in New York, in cents per pound

Date		Average week ending	
July 23	23.50	June 17	17.58
" 24	23.50	" 24	17.89
" 25	23.50	July 1	18.37
" 26	23.50	" 8	18.53
" 27 Sunday		" 15	20.29
" 28	23.50	" 22	21.50
" 29	23.50	" 29	23.50

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	29.53	23.50	20.43	July	29.67	26.00	....
Feb.	34.57	23.50	17.34	Aug.	27.42	26.00	....
Mch.	36.00	23.50	15.05	Sept.	25.11	26.00	....
Apr.	33.16	23.50	15.23	Oct.	23.50	26.00	....
May	31.69	23.50	15.91	Nov.	23.50	26.00	....
June	32.57	23.50	17.53	Dec.	23.50	26.00	....

The month of July will witness an actual reduction in the volume of unsold copper stocks which has been piling up since last November. The principal factor in bringing about this result will have been the sales which started last March and which called for delivery for the most part during July. Newly purchased stocks which were reported in the June bookings, aggregating between 150,000,000 and 200,000,000 lb., further strengthened this condition. The sales sheets of the various selling factors have by no means been uniform as to the proportion of surplus each has sold, but today, it is understood, every one of them has at least started to deliver more copper than current rate of production. One of 'the big three' has been encroaching for some time on its unsold reserve stock, while another has just started to [illegible]. Consequently, the 40,000,000-lb. surplus which existed at the beginning of the year, while the smaller Lake companies have sold themselves into practically the same position.

TIN

Prices in New York, in cents per pound:

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	44.10	85.13	71.50	July	62.60	93.00	....
Feb.	51.47	85.00	72.44	Aug.	62.53	91.33	....
Mch.	54.27	85.00	73.50	Sept.	61.54	80.40	....
Apr.	55.63	88.13	72.50	Oct.	62.24	78.82	....
May	63.21	100.01	72.50	Nov.	74.18	73.67	....
June	61.93	91.00	71.83	Dec.	85.00	71.52	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market according to quantity. Prices, in dollars per flask of 75 pounds:

Date		Date	
July 1	97.00	July 15	100.00
" 8	100.00	" 22	100.00
		" 29	105.00

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	81.00	128.06	103.75	July	102.00	120.00	.
Feb.	126.25	118.00	90.00	Aug.	115.00	120.00	.
Mch.	113.75	112.00	72.80	Sept.	112.00	120.00	.
Apr.	114.50	115.00	73.12	Oct.	102.00	120.00	.
May	104.00	110.00	84.80	Nov.	102.50	120.00	.
June	85.50	112.00	94.40	Dec.	117.42	115.00	.

LEAD

Lead is quoted in cents per pound, New York delivery.

Date		Average week ending	
July 23	5.75	June 17	5.38
" 24	5.75	" 24	5.36
" 25	6.00	July 1	5.40
" 26	6.00	" 8	5.40
" 27 Sunday		" 15	5.42
" 28	6.00	" 22	5.62
" 29	6.00	" 29	5.91

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	7.64	6.85	5.60	July	10.93	8.03	....
Feb.	9.10	7.07	5.13	Aug.	10.75	8.05	....
Mch.	10.07	7.26	5.24	Sept.	9.07	8.05	....
Apr.	9.38	6.99	5.05	Oct.	6.97	8.05	....
May	10.20	6.88	5.04	Nov.	6.38	8.05	....
June	11.74	7.59	5.32	Dec.	6.49	6.90	....

All branches of lead consumption have been expanding. Paint manufacturers are heavy buyers of white lead, and plumbing-supply makers are taking large quantities of sheet lead and lead pipe. Broadening of new building construction is a big factor in the lead market. Lead-covered cable is in increasing demand, particularly for export. Sporting ammunition makers are busy and are taking their full quota. Speeding up industry generally is reflected by expanding demand for solder and other white metals containing lead.

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound:

Date		Average week ending	
July 23	8.35	June 17	6.88
" 24	8.40	" 24	7.02
" 25	8.35	July 1	7.36
" 26	8.25	" 8	7.45
" 27 Sunday		" 15	7.74
" 28	8.25	" 22	8.17
" 29	8.25	" 29	8.32

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	9.75	7.78	7.44	July	8.98	8.72	....
Feb.	10.45	7.97	6.71	Aug.	8.58	8.87	....
Mch.	10.78	7.67	6.53	Sept.	8.33	9.58	....
Apr.	10.20	7.04	6.49	Oct.	8.32	9.11	....
May	9.41	7.92	6.43	Nov.	7.76	8.75	....
June	9.63	7.92	6.91	Dec.	7.84	8.49	....

FOREIGN EXCHANGE

Sterling exchange rallied somewhat during the week, although fluctuations continued to be violent. Quotations, however, have not the usual meaning, as frequently the extreme figures named do not result in actual transactions. The continued low rates are serious, not so much for the monetary burden that they impose on European importers of our goods as in the menace, which is being more clearly recognized, that threatens our exporters in a drastic curtailment of such purchases. The latest remedial suggestion in this connection is for Anglo-American banking co-operation through drawing by British banks of 'finance bills' on accepting American banks, with the expectation that the reserve banks might agree, at least temporarily, to re-discount these bills and thereby relieve the strain. The committee of foreign exchange bankers named to study the situation has held its first session, at which it listened to the views of various export interests. At other sessions the whole subject will be surveyed from different angles before a report or a program is framed to help solve the situation. Meanwhile, sundry rumors continue to circulate as to the prospects for wholesale banking and business co-operation with a view to needed credit extensions to Europe.

Quotations on July 29 are as follows:

Sterling	Cable	4 [illegible]
	Demand	4 [illegible]
Francs	Cable	[illegible]
	Demand	[illegible]
Lire	Demand	[illegible]

Eastern Metal Market

New York, July 23.

All markets are active and higher except the tin market, which continues very quiet.

Demand for copper is still heavy and prices are considerably higher. Copper at 25c. is the prediction for fall.

Demand for tin is light both for spot and future delivery.

The lead market is strong and higher.

Buying of zinc continues with higher prices recorded and the metal reported as scarcer.

Antimony is in heavier demand and has advanced in price.

IRON AND STEEL

Threats of a strike in iron and steel plants have caused some talk in the last week but it is not taken very seriously. Judge Gary is quoted this morning as not expecting that the movement to unionize Steel Corporation employees and have them strike will succeed. The present outlook is that if a strike is voted by present union workers, it will not be general or serious. Pig-iron output is increasing each week, five furnaces having been added to the total in the last week in the Chicago and Birmingham districts. Export steel orders for the three weeks of July have not held up to the June rate but a heavy movement is expected the rest of the year. Railroad material is noteworthy in the export trade, France wanting 6000 cars and Cuba 1050; the American Locomotive Co. has taken 23 locomotives for export, 12 of them for Java.

COPPER

The market is very strong with prices advancing almost daily. In the last two weeks electrolytic copper has experienced an increase of about 2.50c. per lb. In the last week the advance has been 1.75c. and it was about the same amount the week previous, one day alone witnessing an advance of about 1c. Consumers are alive to the fact that in proportion to future demand and because of the future labor situation the metal may become scarce and they are endeavoring to cover future needs. While inquiry for last quarter delivery is heavy, few sellers are willing to sell beyond September, or in few favored cases October, for which they ask not less than 24c. Electrolytic copper today is quoted, largely nominal because hard to obtain, at about 23.50c., New York, for July-August delivery. Some sales have been made at this quotation. Lake copper is scarce for July-August delivery and is quoted at 23.75 to 24c. for this position. Demand is heavy for both domestic and foreign consumption. One estimate is to the effect that at the rate of selling up to July 20, total sales for the month will approximate 250,000,000 lb. Demands of the ultimate consumer have caused an increase in orders for manufactured copper. This is true of brass also. The whole situation is very strong. A report is current that negotiations for the sale of a large quantity of copper to Germany are progressing and that they must be concluded in a few days through representatives of German bankers and the Copper Export Association.

TIN

Only one day of real activity in this market was reported in the last week, and this is not absolutely confirmed first hand. It was on July 17, when about 500 tons was sold, mostly for future shipment. The prices said to have been involved were about 50c. for future shipment from the East and 51c. for future shipment from England. Compared with prices only a week ago, these are low, but evidently this was caused by the extreme fall in sterling exchange, and some buyers were attracted. Others were, however, frightened, although why they should be is not clear as in such a case the exchange rate concerns the seller largely, so far as risk is implied. July 18, there was an auction sale, by Burling & Dole for the Government, of 175 tons of Banca tin at prices ranging from 65.25 to 67.25c. for the various lots. This was metal confiscated some months ago by the Shipping Board during the War. Although its delivery will not be possible for some little time owing to formalities involved, it is already being offered for re-sale at 68c. per lb. around which level American tin, 99%, is selling. Straits tin, spot shipment, from allocated stocks in consumers' hands is nominal at 70c. per lb., New York. Today's quotations for future shipment are as follows: From England, 51c.; July-August from the East, 51.50c.; Straits tin from England, 52.75 cents.

LEAD

The American Smelting & Refining Co. again increased its price last Friday, July 18, to 5.75c., New York, from 5.50c., New York, which prevailed before. Outside sellers at once followed suit although some were reported to have sold up to 5.60 to 5.65c., New York, before this, as noted a week ago. Already this week sales in the outside market are reported as high as 5.90c., New York, but the metal can still be bought at the Trust price. We therefore quote the market at 5.75c., New York, or 5.25c., St. Louis, for early delivery.

ZINC

The market continues to advance and its position is very strong. Increases in prices have appeared daily so that today prime Western for early July-August delivery is quoted at 8.05c., St. Louis, or 8.40c., New York. For September or October delivery, the quotations are from 8.10 to 8.20c., St. Louis. Although demand is not as active as last week, it is still strong and the metal appears to be rather scarce for early delivery, with not much eagerness by sellers to take far future deliveries. Ore prices are also higher in the West, up to $53 to $54, and labor is not abundant. Export demand continues good.

ANTIMONY

Demand has increased considerably and prices are higher. Wholesale lots for early delivery are held at 9.25c., New York, duty paid.

ALUMINUM

No change is noted. No. 1 virgin metal, 98 to 99% pure, is quoted at 32 to 33c., New York, duty paid.

ORES

Tungsten: Demand is light and prices are nominal at $7.25 to $7.50 per unit for spot Chinese ore, $10 per unit for Bolivian ores, and $15 per unit for American high-grade scheelite. There has still been no test of the ferro-tungsten market but it is stated that it could probably be bought for $1.15 per pound of contained tungsten.

Molybdenum: There is no life to the market and quotations continue nominal at 75c. per pound of MoS_2 in regular concentrates.

Manganese: There have been no developments, quotations for foreign ore being nominal at about 60c. per unit.

Manganese-Iron Alloys: British producers have again lowered their price of standard alloy to $105, seaboard, but thus far American makers have not met this and are still quoting $115, delivered. It is believed they would sell at $110 delivered; if so, they would in most cases have the advantage. Sales for export have been made, and one large consumer in the East has effected a commission arrangement for his ore with an American alloy producer for 5000 tons of standard ferro-manganese.

Company Reports

Calumet & Hecla Mining Co and subsidiaries

CALUMET & HECLA

Property: mines, mills, and smelters in the Copper Country of Michigan.

Financial Statement: copper sold at an average of 24.28 cents realized $19,027,052, and at a cost of 19.79 cents the profit was $3,519,755. Adding dividends from subsidiaries, $1,856,941, interest, silver sales, etc., and deducting taxes, etc., the net income for 1918 was $4,949,196. The balance of current assets was $12,565,926 at the end of 1918, a gain of $1,939,441. Liberty Bonds held amount to $4,402,900.

Dividends: No. 183-186 totaled $5,500,000, making $150,750,000 since the commencement of operations. Dividends received from subsidiaries to date are $10,968,077.

Development and Mining: on the Conglomerate lode, shaft-pillars and arches were being removed from the workings of 9 shafts, 81 drills breaking 477,541 tons. It was decided to discontinue sinking at Hecla No. 6 and 7 shafts—7875 and 7977 ft. incline deep—also South Hecla No. 9 and 10—6102 and 8133 ft. deep—on account of cost of maintenance; so in order to reach ground lower in this part of the mine, a haulage-level, at the level of No. 80, connecting with the Red Jacket shaft—4900 ft. vertical—is being driven in an amygdaloid lode 180 ft. under the Conglomerate. The length will be 7800 ft., 2826 ft. of which is finished. From the haulage-level, sub-shafts will be sunk for mining the lower part of the Conglomerate. All of the ore will be trammed by power to the Red Jacket shaft. A total of 10,841 ft. of work was done in this section of the mine, against 2942 ft. in 1917, and 5142 ft. in 1916, and 5522 ft. in 1915.

On the Osceola lode new openings covered 10,192 ft., compared with 16,690 ft. in 1917. Fourteen storage-battery locomotives were installed for tramming.

Production: a comparison of the past four years is as under:

	1918	1917	1916	1915
Ore treated, tons	2,876,392	3,159,570	3,166,274	3,188,583
Average copper, per cent	1.021	1.082	1.120	1.114
Copper from mine, lb.	58,722,969	68,419,826	71,349,591	71,030,518

The reclamation plant, a dredge digging tailing from Lake Linden, handled 715,007 tons of 0.868% copper-bearing material at a cost of 7.2 cents per pound. The re-grinding plants treated this sand and 530,657 tons from the mills at a cost of 4.33 and 6.75 cents, respectively. The ammonia leaching-plant treated 1,005,015 tons of tailing, assaying 0.535% copper, recovering 8,035,156 lb. at 7.71 cents per pound. The total output last year was 67,968,357 lb., costing 19.79 cents per pound; and $3.07 per ton of ore, against $2.52 in 1917, $2.03 in 1916, and $1.71 in 1915.

AHMEEK MINING CO.

Financial Statement: earnings in 1918 were $6,950,161, of which $3,108,141 was profit. Current assets total $3,837,365, and liabilities (including $1,640,000 for Federal tax reserve), $1,830,457.

Dividends: No. 25-28, of $2 per share each on 200,000 shares, totaled $1,600,000, making $11,250,000 since 1911.

Development and Mining: new work covered 13,085 ft., 3000 ft. less than that in 1917. At No. 1 shaft most of the openings and stopes show ground of average quality. This was so also at No. 2. Two electric pumps—one on No. 11 and one on No. 21 level—replaced 8 air-pumps. In July a fire broke out in No. 3 shaft, resulting in 180 ft. of timber and 200 ft. of concrete sets being destroyed. Additional motor-haulage consisted of 3 storage-battery locomotives at No. 2, 2 at No. 3, and 5 at No. 4 shaft.

Production:

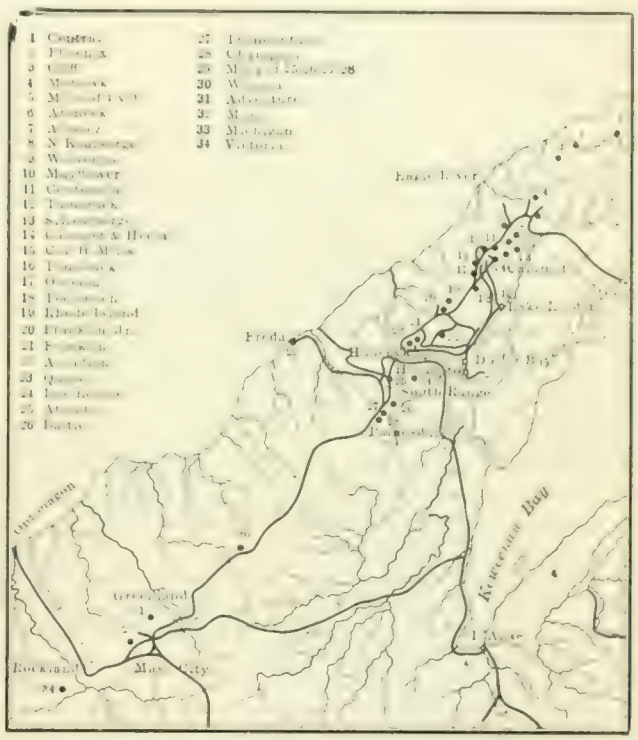
	1918	1917	1916	1915
Ore treated, tons	1,190,541	1,271,275	1,164,010	948,874
Average per cent	1.94	1.10	1.04	1.15
Copper produced, lb.	24,851,235	27,919,812	24,142,158	21,800,492
Cost per ton of ore	$2.180	$1.740	$1.450	$1.260
Cost per pound of copper	0.143	0.091	0.11+	0.079

ALLOUEZ MINING CO.

Financial Statement: of the $1,779,253 received for copper, $361,484 was profit. After paying dividends and providing for taxes, a total of $772,000, the deficit was $410,516 for the year. The balance of current assets was thereby reduced from $1,157,703 to $892,560.

Dividends: the total of $600,000 brought the amount since 1915 up to $2,850,000.

Development and Mining: new work done last year was



MAP OF THE MICHIGAN COPPER COUNTRY

only 80 ft. less than the 2838 ft. in 1917. No. 1 shaft was deepened 191 ft. to 3980 ft., through bad ground. Storage-battery locomotives were installed on No. 19 and 20 levels. On No. 18 of No. 2 shaft, a trolley-type locomotive was put in. New ground opened was generally of average quality.

Production:

	1918	1917	1916	1915
Ore treated, tons	514,888	566,674	566,960	534,705
Average, per cent	0.68	0.78	0.90	0.94
Yield, pounds	7,071,218	8,892,915	10,219,290	10,043,459
Cost per ton of ore	$2.119	$1.869	$1.589	$1.365

CENTENNIAL COPPER MINING CO.

Financial Statement: copper sold realized $553,374, of which $123,734 was profit. After paying dividends, etc., there was a deficit of $81,299, and the balance at the end of 1917 of $436,108 was reduced to $430,717.

Dividends: two absorbed $180,000, making $360,000 since 1916.

Development and Mining: only half of the amount of work done in 1917 was done last year and a third of that in 1916. No. 2 shaft is 4537 ft. deep, and new openings were of slightly lower grade, but stopes were of better quality than in 1917.

Production: 159,040 tons of 0.78% ore was treated, yielding 2,492,857 lb. of copper, 490,000 lb. more than in

the previous year. Costs were $2.275 per ton, a decrease of 5.6 cents. At No. 2 mill, the fourth stamp went into commission during October.

ISLE ROYALE COPPER CO.

Financial Statement: 14,764,718 lb. of copper sold at 24.46 cents realized $3,611,385. Deducting the cost of 16.80 cents, the profit was $1,130,312. After paying dividends the balance for 1919 was $1,134,332, against $890,740 brought forward from 1917.

Dividends: No. 9-13 absorbed $375,000, making $1,950,000 since 1913.

Development and Mining: new work amounted to 12,409 ft., compared with 19,271 ft. in 1917, 17,455 ft. in 1916, and 14,446 ft. in 1915. A total of 84 ft. of shaft-sinking was accomplished. No. 2 is the deepest—3650 ft. At the 7 shafts, the openings indicate respectively that 45, 55, 90, 80, 60, and 50% of the ground will be ore-producing.

Production: the past four years compare:

	1918	1917	1916	1915
Ore treated, tons	974,508	922,160	925,419	680,270
Copper content, per cent	0.79	0.73	0.67	0.68
Copper yield, pounds	15,442,508	13,480,921	12,412,111	9,342,106
Cost per ton of ore	$2.14	$2.02	$1.53	$1.45

OSCEOLA CONSOLIDATED MINING CO.

Financial Statement: deducting the cost of 17.37 cents per pound from 24.41 cents received for 16,380,996 lb. in 1918 left a profit of $1,152,686. After paying dividends and reserving $660,882 for taxes, there was a deficit of $418,429. The balance of assets, $2,633,834, at the end of 1917, was $19,136 greater at the end of 1918.

Dividends: No. 88-93, $10 per share, totaled $961,500, bringing the disbursements since 1878 up to $17,371,775.

Development and Mining: in the Osceola branch was 1219 ft. of work done, and 501 ft. in the North Kearsarge branch. The most active and best part of the Osceola mine was above the 46th level, south of No. 6 shaft. The output of this mine was 30% greater than in 1917, and costs were 4 cents per ton lower in spite of abnormal conditions. Two trolley-type locomotives are to be installed for tramming. In the North Kearsarge, storage-battery locomotives have been highly successful, and another is being put on No. 18 level. Costs increased from $1.55 to $1.69 per ton. In the South Kearsarge the inadequate supply of men caused a decrease of 30% in output, and costs rose 26 cents per ton.

Production: the three mines yielded the following:

	1918	1917	1916	1915
Ore treated, tons	1,194,967	1,237,805	1,284,681	1,361,089
Copper, per cent	0.66	0.65	0.76	0.72
Yield, pounds	15,919,647	16,084,958	19,586,501	19,731,472
Cost per ton	$1.78	$1.63	$1.36	$1.18

SUPERIOR COPPER CO.

Financial Statement: the net operating profit was $18,700, plus $33,080 from sundries. Current assets total $650,398, and liabilities $27,789. The excess of assets, $622,609, is an increase of $133,317.

Development: all the work, 2564 ft., was at No. 1 shaft, on the West lode. This shaft is 3104 ft. deep.

Production: the mill stamped 106,213 tons of 0.78% ore, yielding 1,676,446 lb. of copper, at a cost of $2.682 per ton of ore and 23.29 cents per pound of metal. In 1917 the output was 2,201,672 lb., and 3,034,656 lb. in 1916.

WHITE PINE COPPER CO.

Financial Statement: the profit last year on 3,223,377 lb. of copper sold was $58,743, plus $66,764 from silver, etc., and less $30,028 for preferred shares, taxes, etc., leaving $95,479 net. Current assets total $522,476, and liabilities $102,436.

Development and Mining: exploration totaled 3578 ft., compared with 3479, 5289, and 8605 ft. in the previous three years. No. 2 shaft was sunk 500 ft. to 1578 ft. This is partly vertical, partly curved, and partly underlay. A new hoist was erected.

Production: a flotation plant was installed at the mill, and is a success; but the loss in tailing is still high when compared with the mines in the Houghton district. There was treated 194,568 tons of 0.84% ore, against 212,889 tons and 0.95% in 1917. The output was 3,273,680 lb., a decrease of 793,849 lb. Costs rose to $2.984 from $2.365 per ton.

BUTTE & SUPERIOR MINING CO.

Property: zinc-silver mines and mill at Butte, Montana.

Operating Officials: J. L. Bruce, general manager; Charles Bocking, assistant; Angus McLeod, mine superintendent; E. V. Daveler, mill superintendent; O. J. Zook, chief mechanic.

Financial Statement: the past two years compare as under:

	1918	1917
Revenue from spelter, silver, etc.	$6,922,803	$7,817,674
Less freight	1,007,559	1,101,237
Less operations at mine	5,263,320	4,595,501
Operating profit	$651,925	$2,120,936
Profit (plus other income, minus taxes)	628,348	1,987,480
Surplus at end of 1917	5,070,306	
Surplus at end of 1918	$5,698,654	
Net current and working assets	$3,884,570	$2,901,671

Dividends: none were paid, in view of pending litigation and general conditions, so the total remains at $16,940,000. In the Elm Orlu apex suit, the Butte & Superior lost, and has to pay $177,707, plus interest. In the Minerals Separation flotation suit, the decision was against Butte & Superior, as discussed in the issue of June 21.

Development and Mining: extensions during the year totaled 33,459 ft., also 3772 ft. of diamond-drilling. The accident and repairs to No. 1 shaft reduced greatly the operation of this outlet from May to November. No. 2 shaft was completed to a depth of 1900 ft., stations completed, concrete put in where necessary, and an electric quintuplex pump installed. No. 3 shaft was completed to 2103 ft., and was the outlet for 85% of the year's production. Stoping operations on the Deadwood vein, to the north of the Rainbow lode, give expectations of ore-shoots in the north-west veins. There are also large orebodies at the extreme eastern end of the mine beyond the east end-line of the Black Rock claim, as proved by exploration on the 1600 and 1700-ft. levels under the Four Johns and Raymond claims. Owing to the extra amount of work necessitated by the apex suit, reserves show a decrease of 229,200 tons to a total of 830,000 tons. This ore averages 17% zinc and 5.7 oz. of silver per ton. The direct cost of mining was $7.19 per ton, an increase of $2.04.

Milling and Production: improvements to the mill were nominal, being only minor alterations in the flow-sheet. The new coarse-crushing plant, at No. 3 shaft, was started in May. The fine-crushing department now consists of three sets of 54 by 20-in. Garfield rolls and one 8 by 6-ft. ball-mill. The grade of concentrate was raised by 3.74% in zinc and 2.23 oz. in silver, and recovery increased by 1.84%, due to the improvements. The mill treated 468,814 tons of ore assaying 15.928% zinc and 6.335 oz. silver, 92.965% of the zinc being recovered. The concentrate—135,543 tons—averaged 51.217% zinc and 20.029 oz. silver. Lead concentrate—2790 tons—carried 39.557% lead, 23.858 oz. silver, and 12.2% zinc. All concentrates and residues were sold, and contained 4702 oz. of gold, 2,781,394 oz. of silver, 139,522,506 lb. of zinc, 11,956,951 lb. of lead, and 1,293,313 lb. of copper.

INDUSTRIAL PROGRESS

INFORMATION FURNISHED BY MANUFACTURERS

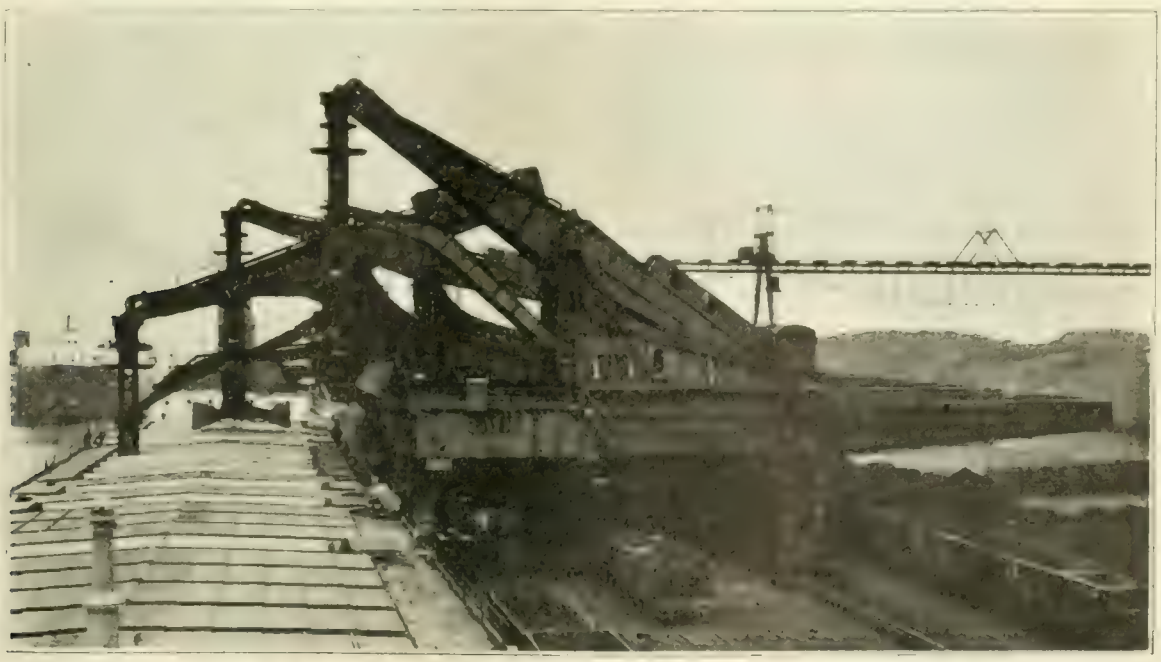
AUTOMATIC ORE UNLOADER

The automatic unloader shown in the illustrations is unusual in design, and has proved through many years of service to be one of the most successful devices for unloading cargoes of ore from Lake steamers that has ever been devised. Although of immense proportions, the design has been simplified and the control perfected to such a point that the Wellman-Seaver-Morgan Co. considers the machine to be the last word in delicate control and operation.

The unloader consists of a main framework mounted on trucks, which travel along the runway rails placed approximately as shown in the photograph. The main framework extends back to the rear runway over a temporary storage-pile, where the ore can be discharged if desired. Between the front and rear runways, space is provided for railroad tracks, where ore-cars are placed under the machines and loaded for transportation to blast-furnace plants. The girders of the main framework form a support for runway rails, on which a trolley travels. This trolley supports a balanced walking-beam, from the outer end of which a stiff bucket-leg depends. At the lower end of this leg is the bucket, which is operated by machinery on the walking-beam. All horizontal movements of the bucket are accomplished by means of moving the trolley backward and forward on the girders. The vertical movements of the bucket are accomplished by the operation of the walking-beam. The forward portion of the beam being out of balance, the bucket descends by gravity as soon as the brakes of the hoisting mechanism are released. The hoisting mechanism controlling this operation is in the enclosed house at the rear end of the walking-beam. Ropes from the winding drums of this mechanism pass around sheaves at the rear end of the trolley, and are anchored to the rear end of the walking-beam.

In addition to the main parts of the machine described, there is also a receiving hopper at the forward end of the main framework, between the main girders, provided for the purpose of receiving ore discharged from the bucket. The capacity of this hopper is three full bucket-loads; its purpose is to act as a balancing point for the ore between the bucket and the cars, or storage, as the case may be. The bottom of the hopper is provided with outlet-gates, and the contents are discharged as required into a larry, which runs on an auxiliary track suspended from the under-side of the main girders. The larry, after receiving its load from the main hopper, moves to a point so that its contents can be discharged either into the cars standing on the railroad tracks beneath the main span of the girders, or into a temporary storage-pile under the cantilever at the rear of the machines. The ore so placed in this temporary stock-pile cannot be reclaimed by means of these machines, as their function is solely one of unloading the cargo from the ships.

Machines of this type have been made in two sizes, the smaller size having a capacity of 10 tons, and the larger (such as is shown in the photograph) having a capacity of 17 tons in the bucket-shells. The machine shown here is electrically operated throughout, and its speeds are regulated so as to operate through a complete cycle in 50 seconds. Some idea of the capacities of unloading by this method may be derived from a record that was made in Ashtabula by 8 machines of this type having a capacity of 15 tons each, un-



Docks of the U. S. Steel Corporation at Conneaut, Ohio. Seven W.-S.-M. Unloaders Are at Work.

loading 7 boats having a total capacity of 70,000 tons in 22 hours actual time. At other points, four machines working in boats having capacities up to 13,000 tons have unloaded these cargoes in 3 hours and 25 minutes.

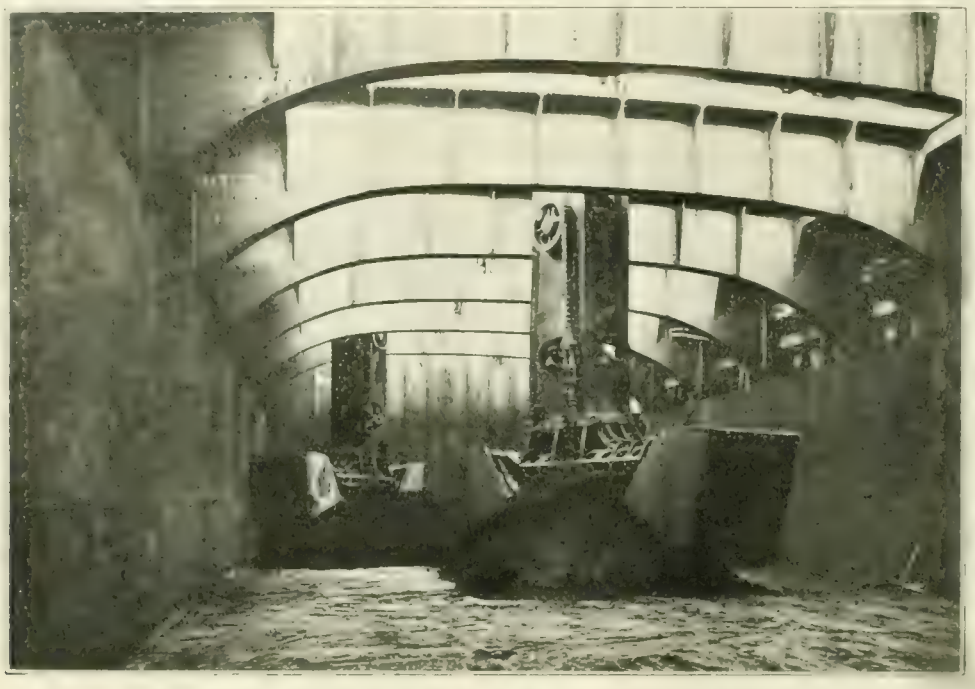
The operation of the machine is as follows:

After the boat has been placed along side of the dock, the machine is moved opposite one of the hatches, and the bucket is lowered through the hatch into the ore. After filling the bucket, the walking-beam hoist mechanism is put in operation and the bucket hoisted out of the boat. At the same time, the trolley is traveled back so that the bucket is brought over the main hopper between the girders in the main framework, and its contents are discharged into this hopper. The bucket is then immediately returned to the boat for another load. The ore in the main hopper is discharged into the larry, which has been brought to a point directly underneath the discharge-gates of the hopper. The larry-hopper is filled, and the larry is moved over the desired discharge-point, and the gates of the larry-hopper are opened discharging the ore as required. The larry-hopper is provided with scales so that the contents are accurately weighed and recorded. In this way, a car can be loaded to its allowable capacity, and an accurate record kept of the amount of ore so discharged into the car, thus eliminating the necessity for the use of track-scales. If railroad cars are not available for immediate shipment, the larry is traveled to a position on the rear cantilever, and its contents discharged into a temporary storage-pile, from which it is usually reclaimed for shipment or storage by means of a bridge on the runway at the rear of the unloader.

Only two operators are required for the entire operation of one of these machines. One of the operators, whose station is in the bucket-leg directly over the bucket-shells, controls all of the motions of raising and lowering the bucket, of traveling the trolley back and forth, and moving the machine along the dock from one hatch to another. The other operator is stationed in a cab on the larry, and from this he controls the movement of the larry, the operation of the larry-gates, and weighing of the ore.

The bucket-shells are each made of a single piece of plate formed to the shape as shown in the illustration. These shells are usually provided with manganese-steel cutting-lips, which are necessary to resist the abrasive action of the ore. The shells themselves are carried on heavy cast-steel arms mounted on rollers traveling in guides in the fixed portion of the lower end of the bucket-leg. The position of the operator who controls the operation of the bucket, etc., as previously described, is also shown in this picture. The view shows the bucket in operation in the hold of the modern ore carrier after most of the ore has been removed, and the remainder of the ore has been scraped into position so as to be cleaned up by the bucket.

The motor for operating and closing of the bucket is in the machinery-house at the back of the walking-beam. Ropes from this bucket-closing mechanism are carried through the walking-beam and the bucket-leg, and attached to a power-drum in the bucket-leg directly over the operator.



Unloader Leg and Bucket at Work in the Hold of a Modern Boat. The Leg is so Mounted in the Walking-Beam that it Can Rotate in a Circle, Allowing the Bucket to Reach Out in All Directions. These Machines Have Often Unloaded 97% of a Cargo Without the Help of Shovelers. The Position of the Operator Who Controls the Movements of the Bucket is Shown. The Distance from Point to Point of the Bucket-Shell When Open is 21 Feet.

This power-drum is geared to the closing-chain drums, one of which is shown. The bucket is closed by rotating the drums in the proper direction; and it is opened by reversing the motor and the bucket-shells are forced open by means of an opening chain in the centre of the bucket-leg between the two closing-chains.

In addition to the vertical movement, which is given to the bucket-leg by means of the walking-beam, it also has a motion of rotation around its vertical axis. This is accomplished by means of ropes attached to a segment on the bucket-leg itself, the ropes being carried back in the walking-beam to a rotating mechanism which is fixed adjacent to the bucket-closing mechanism. The bucket-leg itself is carried on a roller-bearing attached to the top end of the leg. This motion is introduced for the purpose of turning the bucket at right angles to the hatchway, in order to secure as great a reach lengthwise of the boat as possible; thus the bucket is enabled to reach out under the hatches and remove ore which is not directly beneath the hatch opening. The distance from point to point of the bucket-shells when open is approximately 21 feet.

The scale-larry, into which the main hopper discharges, has a capacity of between 35 and 45 tons, and two larry-

loads are intended to constitute a full carload of ore. The arrangement of the discharge-gates of the larry is shown. They are suspended from the sides of the larry-frame and operated by connecting rods which attach to cranks, also connected to the main larry-frame, these gates being operated by means of a small motor which is carried at the rear of the larry. The gates are so arranged that all or a portion of the contents of the larry may be discharged. The hopper of the larry is suspended in the larry-frame on scales, so that the contents of the larry may be wholly or partly discharged and be accurately recorded.

The mechanism for moving the larry back and forth on its track is also on the larry, and consists of winding drums upon which ropes are wound, the end of the rope being attached to the rear end of the cantilever on the main framework. The larry-track is inclined, and the larry is pulled up the incline by means of these ropes and descends by gravity.

As previously stated, these machines are usually electrically operated throughout. In some cases, however, machines of the same general type have been made to operate by steam and hydraulic cylinders, water being supplied to the operating cylinders by means of a steam accumulator, which furnishes water at a pressure of 1000 lb. per sq. in. The electrically-operated machines are usually designed for a 220-volt direct current; alternating current is never used. The motors required for one of these machines are as follows:

Operation	Motor	Horse-power
Beam hoist	1	275
Bucket closing	1	120
Bucket rotating	1	25
Trolley travel	1	120
Hopper gates	1	100
Longitudinal travel	1	100
Larry travel	1	150
Larry gates	1	40

The control for these motors is of the magnetic-switch type throughout, having master controllers in the operators' cabs in the bucket-leg and on the larry. Electric current is supplied to these machines by means of insulated conductor rails running the length of the main runways. The current is collected from these rails by means of pick-up shoes, and distributed to the various portions of the machine. A similar collecting device is also employed for supplying the main current to the trolley. Conductor rails are attached to the main framework of the machine, and the current collected from these rails by means of pick-up shoes attached to the trolley.

Many points of superiority claimed for the Wellman-Seaver-Morgan ore unloader, which are not found in other systems of unloading are: (1) The design is very heavy; there is little to get out of order, resulting in low maintenance cost per ton of material handled. (2) The control is accurate and positive, and manual labor is reduced to a minimum. (3) The bucket is positively guided in passing through the hatches of ships, thus eliminating the danger of damage either to the boat or to the machines, arising from the use of rope-suspended buckets. (4) The operator travels with the bucket into the boat, and can always see exactly what he is doing. (5) The bucket is of extremely large capacity, but is so suspended from the walking-beam that the weight resting on the tank top of a boat is less than one-third of the weight of a rope-suspended bucket of equal capacity; in fact, it is impracticable to use a rope-operated bucket of anything like the size attained on these unloaders. (6) One particularly important point to be considered is the extremely low cost obtainable with these machines. Records extending over long periods show an unloading cost ranging from 2½ to 4½ cents per ton, which includes superintendence, labor, repairs, and materials on the machines, as well as the cost for power and light. (7) On account of the high capacity of these machines, the number of units required is less by a considerable margin than of a smaller type lighter machine, which results immediately in a decreased cost of operation, for the reason that a fewer number of skilled operators is required. (8) Again, on account of the extreme reach of the bucket, it is possible for the machine to discharge a very much higher proportion of a ship's cargo than can be accomplished by ordinary rope-operated buckets. The bucket can be rotated at right angles to the hatch and reach out for ore which would be entirely inaccessible to an ordinary bucket. (9) It can be shown conclusively in plants where large quantities are to be handled that there is a distinct saving in first cost, as well as a yearly saving in the cost of operation, over any other type of machine. And (10) This unloader is not a combined machine. It is an unloader—pure and simple—and it does its work well.

COMMERCIAL PARAGRAPHS

The Terry Mining & Metallurgical Corporation of Salt Lake City, Utah, has licensed the Tomboy Gold Mines, Ltd., of Colorado, to use the Terry Differential Flotation Process in its new 500-ton mill now under construction. In this process differential flotation is effected by the use of ammoniacal frothing agents whereby a high-grade lead, silver, gold, and copper concentrate is made in the first cells, followed by the flotation of zinc. Pyrite is subsequently recovered by tabling the flotation tailings.

The Chicago Pneumatic Tool Co. announces the appointment of L. C. Sprague, formerly district manager of sales at New York, as manager of Western railroad sales with headquarters at Fisher Bdg., Chicago, and H. C. Barbee as manager of Eastern railroad sales with headquarters at 52 Vanderbilt Ave., New York. Nelson B. Gatch, formerly district manager of sales at Chicago, has been appointed district manager of sales at New York, succeeding Mr. Sprague. Announcement of Mr. Gatch's successor at Chicago will be made later.

The Mine Equipment & Supply Co. has been organized at Denver, Colorado, with D. H. Fairchild, general manager; John Saunders, superintendent; Tappan Fox, sales manager; Leverette Davis, consulting engineer; and F. M. Dillon, manager industrial department. The company announces plans for the construction of a forge shop for the manufacture of ball-mill balls, the manufacture of Fairchild twin-discharge ball-mill, Empire concentrating table, Fairchild vertical ore-dryer, and Fairchild magnetic separator. In addition to these specialties, a general sales and jobbing business in mining and milling supplies and equipment will be conducted.

At the annual meeting of the **Denver Engineering Works Co.** the following officers were elected: Frank E. Shepard, president; William W. Torrence, general manager; Edwin S. Kassler, Jr., vice-president and treasurer. Alf. Tellam will continue as metallurgical engineer, Frank A. Lockwood as hoist engineer, and William A. Leddell as sales engineer. Joseph P. Ruth, Jr., inventor of the Ruth flotation machine, has been retained as flotation specialist. The interest in the company formerly owned by the Hardinge Conical Mill Co. has recently been purchased by the present officers and engineers. The Denver Engineering Works Co. will continue to make its line of Dewco mining, milling, and smelting machinery.

The General Naval Stores Co., 90 West St., New York, has issued an attractive pamphlet dealing with its flotation oils. All of the flotation oils manufactured by this company are described with respect to their physical and chemical characteristics and application to various ores. According to the General Naval Stores Co., practically all oils used in the flotation process at the present time fall under the following general classes: pine products produced by both steam and destructive distillation of southern pine wood

(Pinus Palastrus); creosotes from northern hardwoods; coal tar and coal-tar oils. In the steam distillation process the resinous material is removed from the pine wood with steam and solvents. The structure of the wood remains practically unchanged. Aside from pine oil, resin and turpentine, more commonly known products, are obtained by this process. Careful manipulation and technical skill of a high order are required in producing a commercial turpentine with a pleasant odor, one that compares with the pure gum spirits of turpentine extracted from the live pine tree. Only old stump wood is used in the manufacture of all its pine products. With time the resinous material in the old stump changes. No pine oil, only resin and turpentine, is secured from the sap taken from the live pine trees. If comparatively fresh cut or green wood were used, the pine oil secured would be light in gravity and would not contain enough of certain component oils to make a satisfactory and economical medium. In the destructive distillation process the old pine wood is reduced to charcoal in modern steel retorts. The vapors and tars carried over are collected into a crude. Owing to the higher heats prevailing in this process and the complete reduction of the wood, the crude obtained carries a greater variety of compounds than is found in the steam distillation crude. It contains no less than fifty-four definite chemical compounds. Some of these rare compounds are extracted for use in the manufacturing industries. Consequently at the plant using this destructive distillation process this crude has been subject to close study chemically. For flotation purposes the crude is turned into products that embody most effectively the distinctive flotation properties of oils obtainable by this process. In general these destructively distilled oils are more acid in their reactions.

MILES OF RUBBER BELTING

A single order of belting containing 44,254 ft.—approximately 8½ miles—was shipped recently by the B. F. Goodrich Rubber Co., Akron, Ohio, for the Pennsylvania Railroad Co.'s new grain elevator at Canton, near Baltimore, Maryland. The shipment, valued at more than $125,000, is probably the largest single order of rubber belting ever completed in the world. Seven box-cars were required to transport the 131 tons of conveyor and elevator belt, which comprises complete grain handling equipment of this mammoth terminal grain elevator.

Tractor-Truck Train Loaded with 8½ Miles of Rubber Belting.

This belting will handle, store, and tranship Western grain reaching the coast over the Pennsylvania lines—the elevator being specially designed for loading vessels for export and coast-wise trade. It is interesting to note that this belting equipment will make possible the handling of approximately 2,000,000 bushels of grain daily. The rubber belting as packed for shipment shown in the photograph is of two types—elevator and conveyor. The former belts are 32 and 38 in. wide, while the latter are 36, 42, and 48 in. wide. The capacity of one of the 48-in. horizontal carrier belts is 350,000 bushels in a 10-hour day.

The elevator was designed and constructed by the James Stewart Co., of Chicago, who are among the world's foremost grain elevator engineers, and the structure represents the last word in this type of engineering.

WE are amused to note that such an eminently serious periodical as 'The Annalist' should publish an article on the goldfields of Dutch Guiana, with a cordial invitation, on the part of Mr. J. Barkley Percival, to American capitalists, urging them to engage in the exploitation of these goldfields. The article and the invitation have been sent so often from Paramaribo that they ought to be stereotyped just to save time and trouble. Dutch Guiana is good neither for the health nor the purse of the American miner.

J. E. SPURR has been appointed editor of the 'Engineering & Mining Journal' by the McGraw-Hill Publishing Co., which controls the 'Journal' together with nine other publications. Mr. Spurr has achieved enviable distinction as a geologist, for it is a fact, we believe, that no scientific man on the staff of the U. S. Geological Survey has been more successful in analyzing structural conditions with a view to the direct application of such information to the finding of ore. Tonopah and Spurr will always be joined in honorable tradition.

PRODUCERS of copper are to be congratulated on the fortunate shift in market conditions during recent weeks. Business for September has been booked at 24 cents per pound and there is good reason to anticipate a further considerable advance in the price before the end of the year. The surplus of metal is melting before the warmth of increased consumption. European buying is not yet organized and resumption of business with Germany is still subject to restrictions of one kind or another, but the prospects of a large demand from the war-depleted countries is excellent.

SINCE the resignation of Porfirio Diaz, on May 25, 1911, no less than 217 American citizens have been killed in Mexico, according to a statement made by Secretary Lansing. On another page, in our Mining Review, we give the details of the killing of Theodore Patterson, the superintendent of the Mazapil copper mines. He was not an American citizen, but the vivid story of his death at the hands of a Mexican mob is timely. It will remind our readers of the Santa Ysabel massacre on January 9, 1916, when 18 members of the staff of an American mining company were done to death horribly by bandits calling themselves Villistas. We note also the statement made by Capt. John Barneson, on his return from Mexico, that "Americans are the only foreigners doing business in the Tampico oilfields whose lives are not respected. No protection is furnished them and no redress is obtained in the event of their being foully murdered." Capt. Barneson is not the kind of man to talk wildly, so we take his report at its face value.

THE first fruits of prohibition in California are good. In July the number of arrests was 50% below those made in the corresponding month of last year. In San Francisco 1820 arrests were made during July as against 3844 a year ago. The arrests for intoxication were only one-sixth, and of those a large proportion must have been a sequel to the celebrating of John Barleycorn's demise on June 30. For vagrancy in July 1918 there were 1815 arrests, whereas in July 1919 there were only 266. These figures were given an inconspicuous place in our daily newspapers, but they are highly interesting.

IN Mr. McDonald's comment on a statement made by Mr. Hugh F. K. Picard, in his presidential address, he refers to this paper as "a technical periodical," using the word 'technical' in a precise sense. We demur to that, in a friendly way, because the 'Mining and Scientific Press' aims to be more than a record of, or even a forum for, technology; it aims to express the living thought of technical men far outside the mine and mill, the laboratory and smelter. For instance, we publish a most interesting letter from Mr. George Collins on 'Botulism'. That looks recondite, but as a matter of fact it deals with the life and health of men at the mines and it does this in a practical way, that is, in a way likely to promote good health. Again, the letter by Mr. Campbell on the 'English-Speaking Peoples', all the more interesting on account of its opposition to the editor, deals with a subject at least as important as flotation or cyanidation. We recognize that the mining engineer, the metallurgist, and the geologist, together with their comrades in other branches of technical activity, are not merely technicians but thoughtful men and good citizens, to whom all that concerns the daily life of those engaged in the mining industry is interesting. "Man does not live by bread alone."

THE heckling to which Mr. Henry Ford was recently subjected by the lawyers of the 'Chicago Tribune' was, we suppose, to be expected. In a suit for libel it is necessary for the defendant's lawyers to make the most of their case, and to that end unpleasant cross-examinations

are the rule rather than the exception. Yet we must confess but scant sympathy for the press accounts of the episode. With few exceptions the tendency, both in the news columns and editorially, has been to ridicule Mr. Ford from every angle, giving much the same impression as a crowd of small boys that are tormenting a bigger and more able member of their circle who has not a limber enough tongue to defend himself readily. With many of Mr. Ford's actions we do not agree; much he says leaves us cold; but an intelligent person can hardly deny, even if Mr. Ford's method of talking about them has not always been happy, that his achievements in the world of invention and manufacture, as well as the largeness of his vision in business affairs have stamped him as unique in this generation, and we submit that he has deserved better treatment than the press has in general accorded him. This spirit of ridicule has not been manifest only at the recent trial; it has been in evidence ever since Mr. Ford became prominent enough to invite criticism, until he was stung into defending himself by the only honorable means he could command. We wonder how many of the people who smiled as they read his answers to the questions could have done better in that quiet hour in which they read their daily newspaper, without consideration of the embarrassment and mental confusion that accompanies a sharp cross-examination. Even his statement that he could "hire somebody to tell him those things" is exactly in accord with the policy pursued by capable organizers and executives the world over, although again we note an infelicity of expression that perhaps has been the cause for much of the laughter at his expense. We like to think that the national sense of the ridiculous, although not above being petty, is not mean or deep-seated; that the recent deluge of ridicule was merely another evidence of the constant search for something to laugh at; and that beneath the smiles at his eccentricities there is throughout the country a real appreciation of Henry Ford and his works.

A FOOLISH newspaper called the 'Chronicle' gives prominence to an article, by a scribbler named Karl H. von Wiegand, in which General Friedrich von Bernhardi predicts war between the United States and England. Herr von Wiegand is a 'special correspondent' with extraordinary understanding of German psychology, we presume, but he imposes on the credulity of the rest of us by bowing humbly before the vaticinations of such an exploded authority as the author of 'Germany and the Next War'. It is an impertinence to the readers of this San Francisco paper to print such stuff and from such a source. It was Bernhardi who preached the doctrine which the Germans put to the test, so disastrously for themselves and for the world at large, just five years ago. He preached that war is "an indispensable factor of culture," and "a biological necessity"; he denied international law and insisted that "no power exists which can judge between States"; to him "might is at once the supreme right"; he rhapsodised on the "ennobling effect of war"; he ridiculed the idea of a weak nation having "the same right to live as the powerful and vigorous nation"; he asserted that "the whole realm of human knowledge was concentrated in the German brain," and complacently assumed that "no other people could follow the bold flights of German genius or soar aloft to the freedom of our world citizenship." He said that "England committed the unpardonable blunder of not supporting the Southern States in the American War of Secession"; he insisted that "English imperialism has failed to link the vast empire together, either for purposes of commerce or defence." Tell that on Vimy ridge and on the heights of Gallipoli! He anticipated "a great English colonial war" and he expressed the opinion that "France must be so completely crushed that she can never again come across our path." Ask the Crown Prince how he fared at Verdun! The British "have at their disposal a militia" but, he added, "they can be completely ignored so far as concerns any European theatre of war." Shades of the gallant dead, rob him of sleep until he dies! Of the regular army, he said that "its military value cannot be ranked very highly." "It is very questionable whether the English army is capable of effectively acting on the offensive against continental European troops." Ask Von Kluck and the exiled Kaiser what they think now of the 'old contemptibles'! We forbear to quote more than one other of this prophet's sayings: "Every appeal to force finds a loud response in the hearts of all" Germans. It did; it still does; but it finds small response in the hearts of Americans or Britons, both of whom are sickened by the horrors inseparable from the use of force on an unlimited scale. To us another pentecost of calamity is unthinkable. We shall do our best to prevent it. As for war between England and America, let the poor fool that wrote 'Germany and the Next War' murmur his jaundiced anticipations; we can judge him by his last effort in that direction. It may please the German propagandist to foretell conflict between the English-speaking peoples, because the wish is father to the thought, but it is putrid journalism on the part of a paper calling itself "100% American" to publish such an article from Mr. Karl von Wiegand at Hirschberg, in Silesia.

American Potash

In this issue Mr. Herbert H. Roe presents an interesting account of the various sources from which potash is derived in the United States. He gives prominence to the deposit in Searles lake, California, because it is one of the most important and it is one with which he is personally familiar. Searles lake is estimated to contain ten million tons of potassium oxide, and the annual drainage of further natural salts into the valley will yield more, making a supply sufficient to meet American consumption for a couple of centuries, if only it is exploited at a cost low enough to overcome foreign competition. This estimate was given by Dr. H. W. Morse in a recent address before the local section of the American Chemical Society in San Francisco. He insisted, however, that the Trona

Corporation must discard its mechanical evaporating plant in favor of the solar method, such as is used in making common salt. He stated that the brine pumped from Searles lake contains 4.8% potassium chloride, whereas the crude rock mined at great depth at Stassfurt, in Germany, carries 14%. The process now applied to the Californian deposit involves the use of an enormous plant, including single pumps lifting 500 gallons per minute, a pair of storage-tanks each of 300,000 gallons capacity, evaporating-pans 85 feet high, 54-inch vacuum pumps, and the cooling of 5000 gallons of liquor from 90° down to 20° C. in 15 minutes. In 1918 the output was 24,000 tons of salts, but this is to be increased, by adding more apparatus, to 4000 tons per month. On the other hand, the Stassfurt rock has to be crushed, sorted, the salts dissolved out and crystallized, thus making an expensive process. It is claimed that by the use of shallow cemented dams and the aid of the hot sun and dry air at Searles lake, a crystalline concentration containing 14% potassium chloride can be obtained. It is the first step in concentration, raising the potash contents of the brine from 4.8 to 14%, that is so costly; therefore the simpler solar method should prove advantageous. It is fair to add that Searles lake, like mines of which we know, has been the scene of 'a battle of the processes', for the experts seem to have held remarkably discordant views and the consummation of the enterprise has been much retarded thereby, not to mention the litigation over the property itself, as mentioned by Mr. Roe. One purpose of his article is to emphasize the need for protecting the potash industry until such time as it will be able to withstand foreign competition, mainly that of the Stassfurt mines, which are in the hands of the well known Kali Syndicate. It was announced at Washington on August 2 that "German agents are largely responsible for the efforts being made to have the embargo on potash importations lifted." To this was added the hope that "the Department of State might be able to shut out the German product until the American industry, built up during the War, was in a better position to meet foreign competition." One would suppose that the Department of Commerce would have this matter in hand, but they do things in their own way at Washington and we shall not mind which official does it so long as it is done. It is significant that on the same day, August 2, the House of Representatives passed the first protective tariff measure to be acted upon since the Republicans regained control of Congress. The measure in question was one levying high duties on chemical glassware and apparatus; it now goes to the Senate, and it must receive the approval of the chief of the Democratic party. It remains to be seen whether he will exercise his veto as President. To those of us outside partisan politics it appears desirable to assist the development of our domestic mineral resources if it can be done for the eventual benefit of the nation. We are informed that as soon as the Armistice was signed the agents of the German potash companies became active in their efforts to procure permission to invade the American market, and they are supported in these efforts by the manufacturers of fertilizers, to whom a cheap supply of potash salts is desirable. Evidently a clash of interests exists as between the makers of fertilizers and the producers of potash in this country. The State Department, it is reported, "is endeavoring to compromise the situation by proposing that the fertilizer manufacturers use certain proportions of American potash in their manufactures, importing the remainder from either France or Germany." It must be remembered that France, by acquiring Alsace, is now the possessor of important sources of this industrial chemical. The suggested compromise is in accord with Secretary Lane's bill, which failed of consideration in the last session of Congress, in which it was proposed to regulate importation by compelling consumers of potash to use 20% of the domestic product with 80% of the foreign product, and forcing them to show that they did use their domestic allotment before they could procure the imported potash. It will be noted that another Department, that of the Interior, is taking a hand. This is typical of the rivalry and confusion created at Washington by the overlapping of the various branches of the Administration, and it may prove a factor unfavorable to decisive action by Congress. It is to be hoped that those convinced of the advisability of stimulating the domestic production of potash by restricting importation will act in concert, with a view to the enactment of requisite legislation. In 1918 the maximum price was $6 per unit (of 20 pounds) on a 35% K_2O product; soon after the Armistice the price dropped to $4; now it is $2.50 per unit. Before the War the price of German potash was 80 cents per unit. This low price is not likely to be maintained, for it has been reported recently that the potash producers have asked the German government for permission to double the price of their output owing to the increased cost of production since the War. However, even at the doubled price they will be able to invade our market unless the American producer is protected until he has developed the domestic industry to greater commercial strength.

Government and the Cost of Living

Among the coruscations of the Ford libel suit, we note Professor William A. Dunning's statement that "the essence of government is force." This bit of wisdom came like a flash of lightning in the darkness of nonsense. There are those who seem to think that the essence of government is talk, so they load the 'Congressional Record' with their lucubrations. Others seem to think that government is synonymous with legislation, so they pass laws the effect of which they can only vaguely anticipate. At the present moment the lack of force in government is evident in all the principal countries of the world. Indeed the outlook is anything but cheerful. The Bolsheviki may be rampant in Russia and the 'istas may be on the rampage in Mexico, but what of our leading exponents of the democratic idea, England and the United States? On the first day of August our morning newspapers told

us that the president of the Brotherhood of Locomotive Engineers had given notice that unless the wages of the train-men were increased or the cost of living reduced, there would be a big strike on October 1. When organized labor uses the threat of paralyzing railroad traffic over the entire country in order to get an increase of wages—already raised several times since the Government assumed control of the railroads—it is engaging in sabotage. The next day another leader of the Brotherhood stated that the railroad workers "would not stand for a survey of the entire wage situation." He wanted to use the club at once; indeed, 130,000 workers in the railroad-shops would not wait even for a day, and went on strike forthwith. In England matters are even worse, for not only had the cotton operatives of Lancashire, the coal miners of Yorkshire, and the dockers of Liverpool stopped work, thereby increasing the cost of cotton, coal, and food, but a triple alliance of railway men, miners, and transport workers was threatening a general strike, and, worst of all, the police, the guardians of the law, menaced the very foundations of orderly government by themselves going on strike. Meanwhile British taxpayers are meeting the cost of the pay given to the unemployed by means of a Government dole. Returning to our own country the race riots at Washington and Chicago presented another most lamentable spectacle of lawlessness. Whether these outbreaks between negroes and white trash were due to the desire to kill awakened by military service or whether they were due to attacks on white women, we do not know. Statistics show that only 25% of the lynchings perpetrated in the last 18 months were due to the cause commonly supposed to explain these horrors. We conclude that the bloodshed and incendiarism at Chicago and Washington may be ascribed in large part to shortage of food and secondarily to the brutishness engendered among the weak-minded by the experience of warfare. Most of the unrest and violence recorded recently among laboring people is due, we believe, on such evidence as is obtainable, to the irritation caused by the high cost of living and the belief that much money is being made by profiteering. Telegrams from Washington say that the Attorney-General is taking the matter in hand and has started by calling a number of chiefs of departments into consultation with him. We are told also that the President "is giving deep and very thoughtful consideration to the problem." It is well that he should, for, unfortunately, most men and women are more sensitive to matters affecting their personal comfort than they are to the larger questions of politics or even the idealisms of international concord. We see no reason why the President should not submit the question to men so experienced in national alimentation as Messrs. Herbert Hoover, Alonzo Taylor, and Vernon Kellogg, for example. Surely it is possible to do something effective. Meanwhile we venture to say that whether it be possible to decrease the cost of living or not, it is possible to stop the rank profiteering that is evident on every side. Each one of us can cite examples within his own experience. Every tax is used as an excuse for collecting not only the impost itself, but an additional amount of profit for the seller. Even the man who sells pop-corn gives you a bagful of half the former size for the customary nickel. Why, the rancher from whom we bought eggs excused his raise in price by saying that the War had increased the demand for shells! Joking apart, every man or woman can quote examples of inexcusable prices, based simply on the idea of using the opportunity to profiteer. Agreements exist between producers to control markets, prices are fixed arbitrarily from day to day, food is destroyed in order to maintain high quotations, carloads of fruit are allowed to rot rather than reduce the cost to the public, enormous quantities of foodstuffs bought by the Government for the Army have remained unused. These are matters of common knowledge, and they evoke a keen feeling of resentment. How far the artificial price of wheat has contributed to this state of things, we do not know, but it might well be an act of wisdom to sell this year's wheat at a more nearly normal price and keep faith with the farmers by giving them a bonus out of the guarantee fund. Cheaper flour might lead the way toward a more reasonable market in all staples of food. The train-men's demand for a cut in the high cost of living by October 1 may be preposterous, but it is certain that the subject is one that is engaging the attention of the population of this country, and of other countries, to a point threatening to stop the great measures of international readjustment embodied in the Treaty of Peace and the League of Nations. The force implicit in government can be used to no better purpose than in preventing the hoarding of food-stuffs for the purpose of creating an artificial scarcity or in disciplining those who under cover of abnormal conditions set to work to exact excessive profits on the sale of the essentials of life. The force accorded by the people in a democracy to the government is supposed to be used for the general good in restraining those whose actions are subversive of order or otherwise hurtful to the community. It is assumed that the representatives of the people are given the power of government in order that other citizens may go about their business undisturbed. We elect our representatives, in the municipality, the State, and the Nation, to perform this function because the people themselves cannot perform it. The alternative is mob-rule or a war of parties. When Abraham Lincoln spoke of government "by the people," he did not mean it literally, for that were impossible, the governing being done by the representatives of the people in behalf of all the people, rich or poor, wise or foolish, white or black. It is just as necessary that the labor-unions or the industrial corporations should not arrogate to themselves the settlement of affairs that concern all of us as it is that our representatives shall have the initiative and the intelligence to use the force entrusted willingly to them for the benefit of all the people; in other words, government need not cease to be virile because it is democratic. Just now the first duty of statesmanship is to abate the high cost of living by regulating the sale and distribution of the necessaries of life.

DISCUSSION

The Chloride Volatilization Process

The Editor:

Sir—Mr. Blamey Stevens has presented an excellent digest of this process in your issue of July 12. I wish to comment on the paragraph in which he says, "but laboratory experience shows that sulphides in quantities are detrimental and that the reaction of the salt on silica is even better suited to the formation of metallic chloride."

It is well known that salt is decomposed by silica, yielding chlorine, or, in the presence of steam, hydrochloric acid. I do not deny that this reaction can be used for the conversion of metals into their chlorides, but in the volatilization process for the treatment of ores I do not feel that it has been proved in any degree that this reaction is the one that takes place. My original experiments invariably showed that the nearer the percentage of sulphur approached the amount necessary to form the normal sulphide of the volatile metal, the better was the percentage of volatilization, assuming that an intimate contact between the sulphide and the salt was obtained during the roast. In commercial operations it would be impossible, of course, to prove this rule on ores containing only gold or silver with no volatile base metal, because the amount of sulphur combined with the gold or silver would be infinitely small; but in ores containing lead, for example, the sulphur combined with each per cent of lead to form the normal sulphide is only 0.155%, which is sufficient to form a complete reaction with the salt and produce a volatilization of the lead.

I have been told that much of the experimental work in Utah has been done on oxidized ores containing about 2% lead. This would require, therefore, only 0.3% sulphur to secure a commercially complete volatilization of the lead, and any silver or gold present would be volatilized at the same time by similar reactions. There are few oxidized ores of this character that carry less than 0.15% sulphur in some form, for each per cent of lead present. Since the SO_3 radical will attack salt at a much lower temperature and hence more quickly than the SiO_2 radical, I do not see any foundation for the claim that the chlorination of the volatile metals in ordinary ores is attained through the decomposition of salt by means of silica.

In further support of the above-mentioned statement, it is true that the excess of sulphides has always proved detrimental, but from the very fact that the salt and sulphur are the first to react. Let us take, for example, an ore containing a small percentage of galena and considerable pyrite. Salt is added, but not in sufficient quantity to react with all of the sulphur present. The pyrite oxidizing at a lower temperature than the galena, will react with all of the salt and little or no volatilization of the lead will be effected. If sufficient salt is added to react with *all* the sulphur present, including that combined with the lead, volatilization of the lead will take place as long as the oxidation of the sulphur occurs, but, with the formation of so much sodium sulphate, the particles of ore are soon coated with this easily fusible salt and are thus removed from the oxidizing atmosphere, so that further reaction and volatilization cease.

For another example, let us consider a sulphide ore with opposite characteristics, like the Broken Hill ore in Australia. In this, one might expect the more easily oxidized galena to be volatilized in preference to the less easily oxidized zinc sulphide, but the latter oxidizes with sufficient rapidity to react at all times with the salt, and volatilization is again controlled by the relation of salt and sulphur without regard to the silica present. If, on the other hand, the ore be preliminarily roasted to reduce the sulphur content to the amount that will theoretically form a normal sulphide with the lead present and then sufficient salt be added to react with that sulphur, the lead can be preferentially and completely volatilized from the zinc, as was shown in my original work.*

It will be seen from these examples that, in the case of sulphide ore, the sulphur is the controlling factor for the salt, and if the necessary quantity of salt is added to react with all the sulphur present in the ore, the detrimental effect is due to a physical cause, namely, the fusion of the sulphate of soda around the ore particles, which stops chemical reaction and is not due to chemical causes. Otherwise, complete volatilization of the metals could be effected without difficulty.

We found it impracticable to use more than 10 to 12% salt on any ore; consequently the sulphur in the ore treated should not exceed one-quarter of this amount, that is, 2.5 to 3%.

The sintering of the ore will depend largely on the composition of the gangue. A silicious ore, roasted with 10% salt, has a tendency to nodulize in a cylindrical furnace, probably as a result of the formation of sodium silicate as well as of sulphate. These nodules disintegrate to the original sandy condition on exposure to the weather. Neutral ores, or those containing iron and lime bases in sufficient quantity to form an easily fusible slag with the silica, naturally have a still greater tendency

*'Engineering & Mining Journal', August 29, 1903.

to fuse or sinter with the addition of the sodium salt. Base ores, or those having a large excess of iron and lime, discharge from the furnace in the same sandy condition as they were when charged, and are the most satisfactory ores to treat by the volatilization method.

In regard to furnaces, we found the cylindrical furnace the most satisfactory type to use, and in our experimental plant we used a White-Howell furnace lined throughout with brick. It was 25 ft. long and 3 to 4 ft. in diameter. In my original paper I recommended furnaces of this type 30 to 50 ft. in length with proportionate diameters. Such furnaces were installed in the Mayer plant. I do not know the size of the furnaces used in Utah, but, like pioneer installations in many other lines of endeavor, I now believe that all these furnaces were too small, and that a regular cement kiln 75 to 100 ft. long would give better results. In the early days of electric tramway installation it was thought that if two horses could pull a street-car, a 15-hp. motor would be ample for electric propulsion. It was soon discovered that a 30 or 40-hp. motor was necessary to yield satisfactory results. It is reported that Curtis was able to fly with the ill-fated Langley aeroplane when he equipped it with a more powerful motor.

The volatilization of metals can be completed in 20 to 30 minutes and better results can be obtained by passing a thin stream of ore through the furnace at this rate of speed than by carrying a heavier bed of ore and roasting a longer period of time.

Now that the Cottrell process has solved the fume difficulty the remaining unknown is the commercial efficiency of the furnace. All subsequent investigators have confirmed but added nothing to my original results. The volatilization and recovery of potash have been commercially demonstrated at cement-plants. It would appear from these, that it is not "investigation by expert chemists" that the process needs, but a more powerful motor to make the known factors operative.

Denver, July 15. STUART CROASDALE.

Mr. Picard's Address: Saying and Doing

The Editor:

Sir—In commenting editorially on the presidential address of Mr. Hugh F. K. Picard before the Institution of Mining and Metallurgy, you said, in your issue of July 5, that the excellent principles which he so ably propounded are "evidently of an academic character and intended for non-domestic application." You intimated that while he preached in a very generous and high-minded fashion, the Minerals Separation company, of which he is an important part, practises in a manner exactly the reverse. One of your sentences was: "It is inconceivable that a technician capable of an outlook so scientific and philosophic, as that embodied in the presidential address, could have advocated the steps taken by the Minerals Separation company, in this country, to gag the profession."

Now, I wonder whether the policy of publicly advocating high-sounding and inspiring principles, particularly before dignified bodies, and then acting exactly contrary to them, is so inconceivable and uncommon as you imply. Is Mr. Picard alone in this seeming inconsistency; do not other "philosophical technicians" and industrial leaders do likewise, or, for that matter, leaders in business and politics generally? In other words, is it not the custom for an eminent man, when called to 'make a speech', to utter soul-inspiring cheer-arousing sentiments which he really does not believe in at all?

Perhaps it is because we are so practical a people that we do not practise what we preach; perhaps it is because we like the sound of pleasant words. Emerson said: "What good, honest, generous men at home will be wolves and foxes on 'change'. What pious men in the parlor will vote for reprobates at the polls." There is an old aphorism that says that between saying and doing, a man may marry his daughter; and Macaulay said: "Only imagine a man acting for one single day on the supposition that all his neighbors believe all that they profess and act up to all that they believe."

Undoubtedly a young engineer accustomed in his college work to proceed logically and consistently has to learn the difference between words and actions when he gets among so-called practical men. It is in "the college of hard knocks", as 'Life' has called it, that the young man finds out such great empirical truths. Though this matter is not a technical one in the sense that the 'Mining and Scientific Press' is a technical periodical, it has a very direct bearing on technical matters, such as, for instance, the flotation process.

P. B. MCDONALD.

North Adams, Massachusetts, July 10.

The Leaching of Flotation Concentrate

The Editor:

Sir—Mr. Greenawalt's letter in your issue of June 28 on the leaching of flotation concentrate should prove valuable and enlightening to those who are giving attention to the leaching of copper, whether from concentrate or ore. In the case of the leaching of material containing the copper as a sulphide, arsenide, or native metal, the following quotation is apt and should be emphasized: "I am convinced now, as I was then, that the solving of the problem of the ferric salts will be along the lines of making the iron work with the process." On the other hand, for the leaching of oxidized material, this can hardly apply.

There was a time when the future of the treatment of copper ores with ferric sulphate might have looked as bright to those who were looking forward in copper metallurgy as the electrolytic refining process itself, but early difficulties, which were not overcome at the time, have relegated this process to the background most decidedly; nevertheless this procedure has great intrinsic merit, perhaps as great as electrolytic refining. In this process, if metallic copper or copper sulphide (some sulphides, such as chalcopyrite, react very slowly unless

finely ground is treated with a solution of ferric sulphate, which can contain free sulphuric acid or not copper goes into solution as sulphate, and the iron is reduced to ferrous sulphate, thus

$$Cu + Fe_2(SO_4)_3 = CuSO_4 + 2FeSO_4$$

If a sulphide is being treated, sulphur is left behind unattacked. This solution can be passed through a properly designed and operated electrolytic tank, and with an efficiency of over 90% can be made to yield good cathode copper, and the ferric sulphate solution regenerated, to be used over again in order to carry another batch of copper from the ore or concentrate to the cathodes in the cell. Notwithstanding that this process has not 'arrived', it is nevertheless of great importance for the future.

I have demonstrated the utility and practicability of this reaction by numerous and elaborate experiments, to my own satisfaction. The amount of electric power consumed is reasonable, the copper may be deposited in fine shape, and the solution is cheap and easily handled. Details of these experiments and construction of cells are given in my book 'Lead Refining by Electrolysis', pp. 102-111 and 260-267.

This process differs from that described by Mr. Middleton in your issue of June 7, in that the concentrate or ore must not be roasted before leaching. Even the presence of oxides or carbonates of copper in the ore or concentrate upset the balance of the solution after one or more treatments, according to the percentage of oxidized copper contained; if the amount of oxidized copper is not excessive, the use of reducing agents such as hydrogen sulphide, sulphur di-oxide, and scrap-iron plus the chemical equivalent in sulphuric acid, properly applied to maintain the proper balance, is entirely practicable. The quantity of such reducing agent needed, is ideally, or theoretically (as is usually said), that amount which would reduce the copper oxides to metal, and practically the amount would not be far different.

Nyack, N. Y., July 2. ANSON G. BETTS.

Botulism

The Editor:

Sir—Mr. Shockley's letter on this subject, in your issue of July 5, recalls to my mind a sad case of poisoning by botulism in 1912, at the Mary Murphy mine, when five persons, including mine superintendent, surveyor, tramway construction foreman, a teamster, and a visitor all fell victims to the terrible disease.

It is so deadly in its effects (in our case all the persons affected died, excepting two rather doubtful cases) and so difficult to prevent or diagnose, and moreover, mines in out-of-the-way places are so peculiarly exposed to the danger, that it should be more generally known. As I understand the matter, botulism is caused by a specific anaerobic (one which cannot exist when exposed to air) bacillus, which occurs in the flesh of hogs, and which probably may occur in any nitrogenous food that has not been heated to a temperature exceeding 100°C. It is quite distinct from ptomaine poisoning, which is due to some form of decomposition; the foods infected by botulism are not 'spoiled' in any ordinary sense, and, except from the effects, it is impossible to detect it in the food. A large proportion of the people who contract it die, so that testimony as to the effect of the poison on the flavor and appearance of the food is meager; but there is some testimony which suggests that it is more 'savory' than usual. In the case of canned vegetables a slightly rancid odor has been recorded.

In our case at the Mary Murphy, the official investigators of the State Board of Health attributed the poisoning to canned spinach, but the evidence on which they based their conclusion was later clouded by the fact that one person, who had not eaten the canned spinach, died. Another suspected food was canned string-beans. There was no absolute certainty even as to which meal caused the poisoning. My own belief is that the food which caused the poisoning was sausage (wienerwurst), but several persons who ate of the sausage did not contract the disease. Possibly only some of the individual sausages were infected. The canned spinach, the beans, and the sausage had been subjected to the heat of boiling water, which, if sufficiently protracted should, according to the testimony of all investigators, have destroyed the bacilli and presumably the toxins produced as a result of their existence in the food. I have always attributed the tragic result at the Mary Murphy to the fact that, owing to the altitude of that property, water boils at a temperature below 100°C. I think this point is of the utmost importance—*no pork or ham, and no canned foods, should be eaten unless cooked at a temperature known to be above 100°C.*

All the investigators agree as to the extremely deadly nature of the poison, and that the minutest quantities may cause death. In the Mary Murphy case, death occurred at intervals between 36 hours and three weeks after the suspected food had been eaten. The characteristic symptoms were ptosis of the eyelids, double vision, lack of muscular co-ordination, tenacious mucus in the throat, paralysis of the muscles of the throat, inability to speak, constipation (not diarrhoea as stated by Mr. Shockley) and (perhaps most characteristic of all) intense apprehension of impending death. In every case the patient's mind was clear up to the moment of death.

The first two symptoms mentioned were marked even in the earliest stages. An English friend who was at the mine as a guest, Mr. Leveson-Gower, seemed to be very slightly, if at all, affected; but careful testing showed evidence of these two characteristic symptoms 36 hours after the poisoning, although he was in no way inconvenienced at that time. In fact, the mine doctor had pronounced him entirely unaffected; and it was merely as a matter of personal interest that I tested his ability to walk a straight line, etc. Nevertheless, other symptoms developed a few days later, and in his case also death occurred two weeks after the poisoning; although by that time the serious nature of the disease was fully realized, and the best of medical skill and nursing was

available. Apparently there is no cure; unless a serum treatment, on which Van Ermengem was working several years ago, has since been perfected. The disease however is so rare, and so obscure, that it is hardly possible such a serum could be generally available for use. The only complete safeguard seems to be adequate cooking of all preserved food.

GEORGE E. COLLINS.

Denver, July 10

The English-Speaking Peoples

The Editor:

Sir—The Bulletin of the Canadian Mining Institute for March last contained an article by yourself entitled 'The English-Speaking Peoples'. Practically the only reference to Canada in that article was in regard to the War of 1812. To quote your own words, "The so-called War of 1812 . . . was a tempest in a teapot: on land it was badly fought by both sides." As practically all the land fighting was in Canada and on this side was done by Canadians assisted by a few British regulars, your statement means that you consider that the Canadian forces fought badly. I went to some trouble to give you in a personal letter a Canadian point of view and as I have lived in Canada all my life I feel that I am somewhat in touch with the Canadian sentiment in this matter. I asked you in future, when dealing with Canadian history, to give us better consideration. I was prepared to let the matter drop there.

I have no apology to make for anything I said in my letter. Apparently, however, I wasted my time for in your issue of June 28 you not only re-print your article with the offensive paragraph intact but you publicly denounce me and other Canadians who may "hark back to 1812" as having jaundiced minds, belonging to the class of Bourbons who can forget nothing and learn nothing, etc., etc. Your claim that because your ancestors came from both the American and British nations you are qualified to pass judgment on Canadian affairs is worthless. Canadians have suffered nearly as much from British historians as from American. Too many British people because their ministry was wrong in their treatment of the American colonists consider the whole matter a distasteful subject and accept the American version not only for the American Revolutionary War but also for the War of 1812.

I do not propose to enter into any argument in regard to causes and actions during the war. You can believe with certain New Englanders and New Yorkers of that day that the cause of freedom would have been better served by declaring war against France instead of England or you can believe with Lyman Abbott in the New York 'Outlook' that the Americans "won for themselves and all humanity that freedom which had been denied them." You can believe with the New York 'Life' that "if the American militia had been any good in 1812 Canada would now be a part of the United States", or you can believe with your juvenile friend that the Americans "licked" the British, that it was a no account war and that the Canadians fought badly. The point I wish to make is that Canadians believe that their forces saved this country for the Empire in the day that the parent looked after Napoleon, and that was no mean achievement.

The War of 1812 was the outstanding event in Canadian annals in the last century. It was more important than Confederation for if the Americans had succeeded in their designs on Canada there would have been no provinces to confederate. Canadian national heroes are the men and women who fought in that war with courage and ability and heroism and who died facing heavy odds. There were many such—there had to be. As long as Canadians believe these things I will leave your readers to judge whether you will help any by attempting to belittle a Canadian national event of the first importance, by a sneer for the Canadian defence of that day and by abuse of those who do not agree with you. "We need more tolerance", you say. It seems a pity that you are unable to take a little of your own advice.

In conclusion I wish to quote a remark by the editor of the 'Canadian Courier' of Toronto, an outstanding Canadian weekly. I would particularly draw your attention and the attention of others who go out of their way to dictate what Canadians should believe, to the last sentence. "The entente cordiale between Canada and the United States is a thing unknown in either Europe or Asia. We expect on this side of the line to make it absolutely fool-proof for the sake of ourselves, the Empire and the Anglo-Saxon Alliance. But if we are to carry our part of the load we are entitled to our own opinions."

C. M. CAMPBELL.

Phoenix, B. C., July 17.

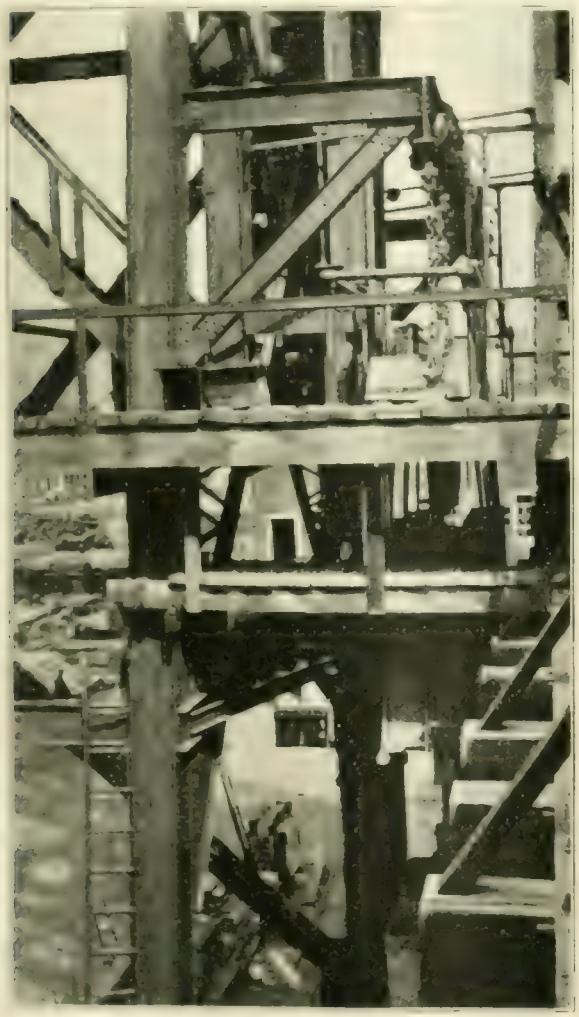
THE buying of copper which has been under way for the past few months has begun to make inroads upon the huge surplus which has been piling up at a rapid rate since last November. It is estimated the country's stocks have dropped below the billion-pound mark. The Government-owned copper, which producers agreed to market within 15 months, has all been sold. Only three months were required to accomplish the task. Originally placed at 140,000,000 pounds, the Government holdings were actually less than 100,000,000 lb. and practically every one of the leading producers took a proportionate part to work in with his own sales. June copper sales were substantial, although they fell short of the May total of 207,000,000 lb. The movement of copper to consuming points was interrupted last month owing to labor troubles at Connecticut manufacturing centres. The July delay will be on the part of producers.

THE production of gasoline in the United States increased tremendously during the War period. Thus, the output of rather less than 50,000,000 bbl. in 1916 was increased in the following year to more than 68,000,000 bbl., and during 1918 the production amounted to over 85,000,000 bbl. Exports, mainly to the Allies, rose from 8,473,102 bbl. in 1916 to 13,213,508 bbl. in 1918.

Skip-Changing Device at the Steward Mine

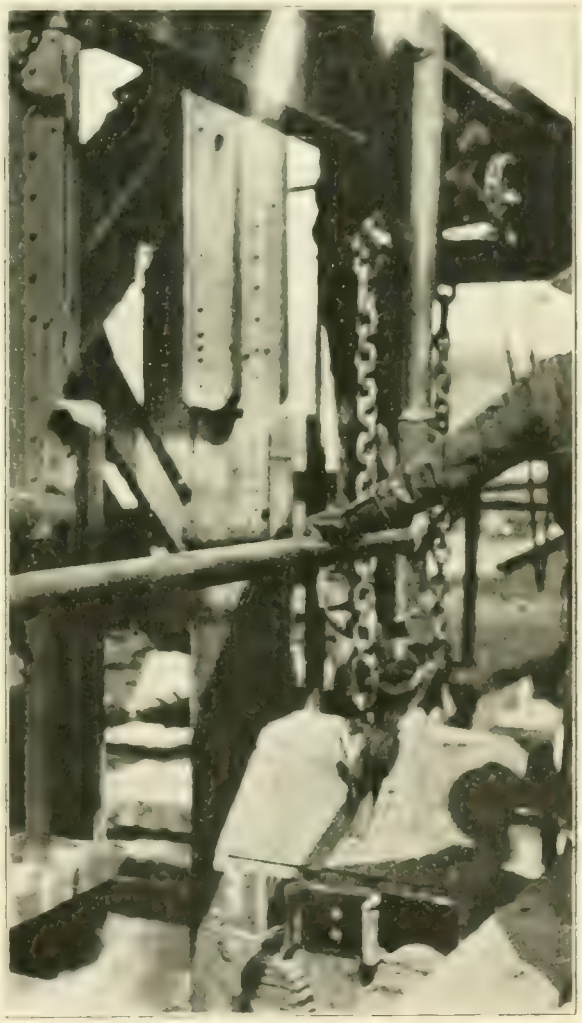
By OLIVER E. JAGER

The device for changing skips at the Steward mine, in the Butte district, Montana, is of the hinged-guide and crawl type. The general arrangement is illustrated in the photograph, which shows the crawls running on a 20-in. I-beam (65 lb. per ft.), supported by brackets attached to the head-frame. The drawing shows the I-beam supported by posts and framing, but this design has been changed in favor of brackets. The I-beam must be set out from the shaft a sufficient distance for the cage or skip to be in the clear when it hangs free on the crawl. This distance will also determine the length of the hanging chains on the crawl, as they must be long enough to allow of their being attached to the cage while the latter hangs in the shaft. There are three crawls with a capacity of about 6 tons each; they have hand-chains and gearing for moving them along the I-beam, but do no lifting.

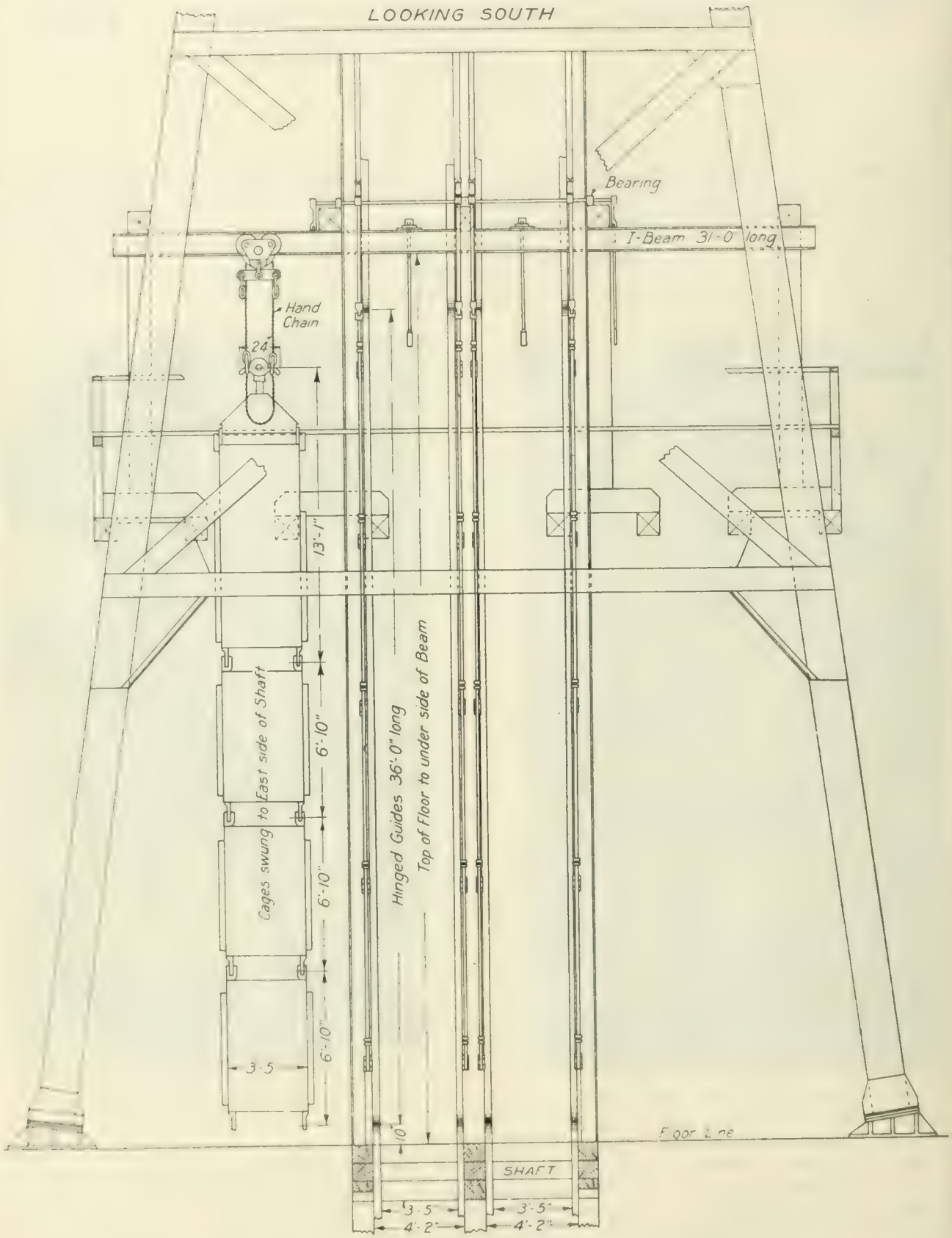


TWO SKIPS CHANGING ON CRAWLS

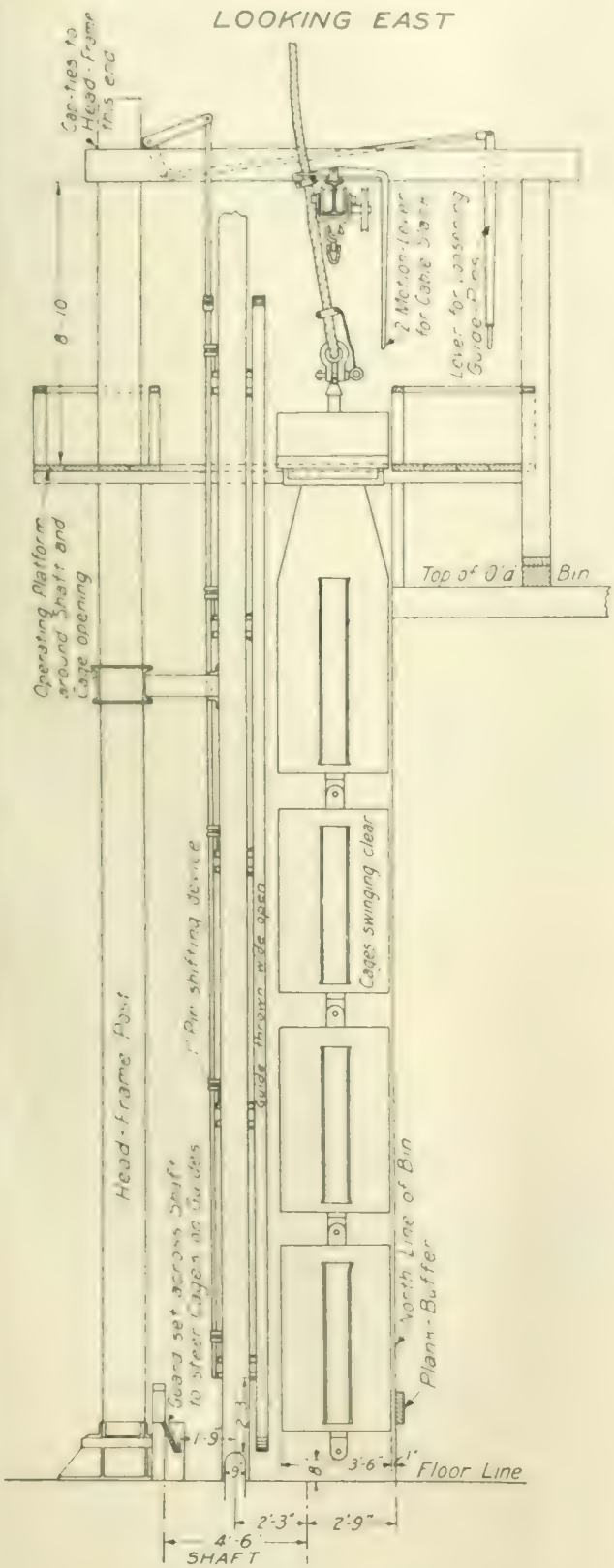
The guides are built up of steel angles, and are hinged for 36 ft., which distance is sufficient to allow the free exit of the string of cages from the shaft, and for the same reason the hinges are arranged to allow the guides to swing clear of the inside faces of the guide-posts, as shown in the near view. The lower extremity of each hinged guide is at a point 10 in. above the shaft-collar, which means that the ends of the fixed guides project that amount when the hinged guides are open. The guides are hinged at five points, and at each hinge there is a pin that locks the guide in normal position in the shaft, provision being made for all these pins to be withdrawn simultaneously on each compartment. This is accomplished, as shown in the drawing, by a lever connected to a bell-crank which actuates the rods carrying the pins. The drawing also shows a lever for holding the



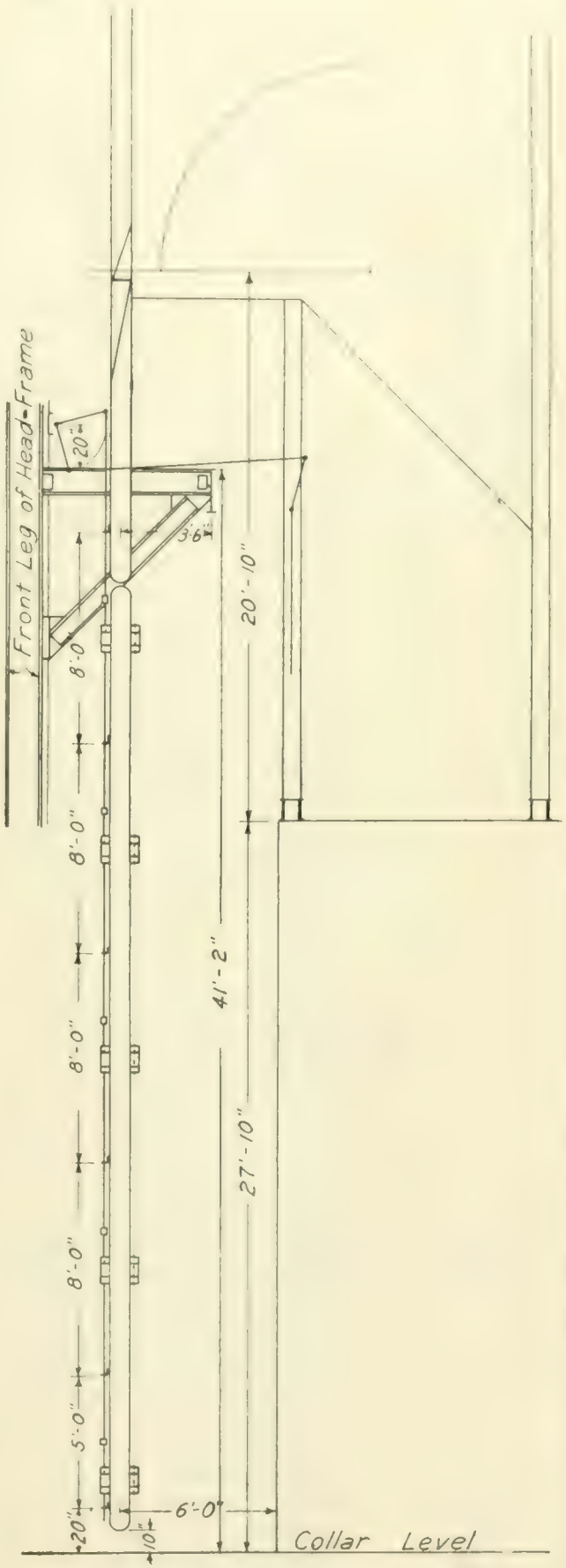
HINGED GUIDES SHOWN OPEN



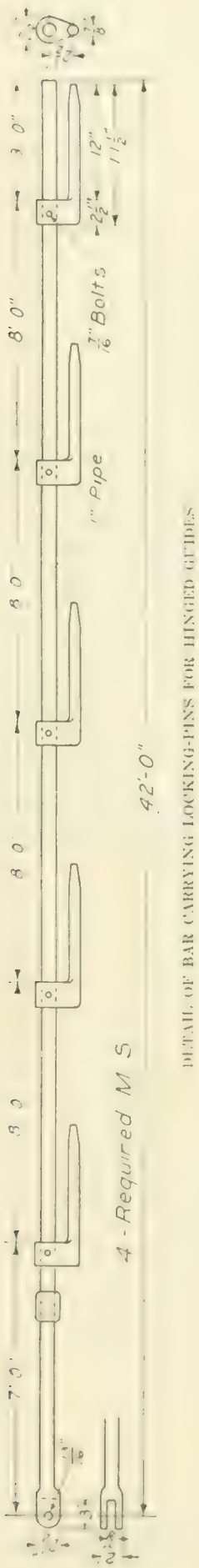
SKIP-CHANGING DEVICE AT THE STEWARD MINE, BUTTE



SKIP-CHANGING DEVICE



HINGED GUIDES AND LOCKING-PINS



DETAIL OF BAR CARRYING LOCKING-PINS FOR HINGED GUIDES

cable while the change is being made. This has been superseded by a hand-bar with a forked end. A platform on the head-frame is placed in a convenient position for performing all the operations in connection with changing skips, while the opening below the I-beam is railed around with 2½-in. pipe for safety.

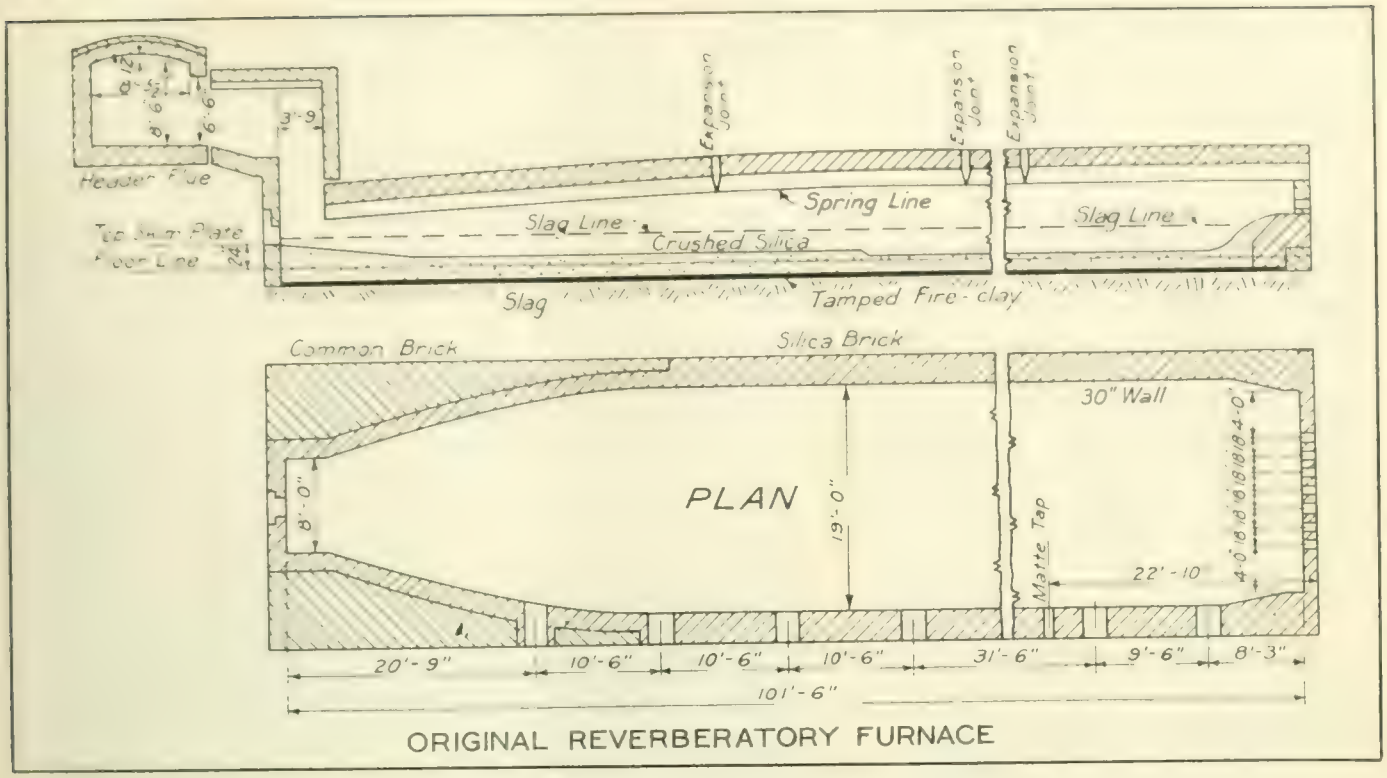
To explain the operation of the device, let it be supposed that the two compartments of the shaft have been working with skips, and that it is desired to change these for cages. Three men are required, one at the shaft-collar and two on the operating-platform. Let the crawls be numbered from the left, No. 1 crawl being empty, while No. 2 and 3 have each a string of four cages hanging on them. The skip in the left-hand compartment is stopped just below the collar of the shaft, and the locking-pins of the hinges drawn. The guides are swung open by a bar in the hands of the man at the shaft. Slowly turning his engine, the hoist-engineer now brings the skip up to a point where the chains of crawl No. 1 can be hooked into special eyes on the crosshead of the skip. On lowering, the skip swings out of the shaft and comes to rest under the I-beam, the crawl carrying it. The two men on the platform now disconnect the rope from the skip and move crawl No. 1 away to the left, bringing crawl No. 2 into its place in front of the left-hand compartment. One of the men, with the forked bar, holds the rope while the other man connects it to the top cage of the string. On hoisting a little, the cages pass over into the shaft, where they are held while being unhooked from the crawl. They are next carefully lowered so as to slide onto the guides at the shaft-collar (assisted by the man with the bar), after which the hinged guides are closed and locked, and the left-hand compartment, with its string of cages in position, is ready to resume work.

The operation is repeated for the right-hand compartment; crawl No. 2, now being empty, takes the skips from the shaft and is moved to the left out of the way, while crawl No. 3 is brought up, relieved of its load of cages and left standing empty. When the change is next made, the operation will take place in the reverse direction, or from the right hand, though it is quite immaterial from which side the change is made. The loaded crawls are easily moved by one man. The time taken in changing skips in the two compartments is from 6 to 10 minutes.

This method of skip-changing has been working satisfactorily for some time. It has the advantage over the swinging-guide type that it requires no compressed air for its operation, nor the excavation and timbering of a chamber beside the shaft collar. For doing light repairs or painting, it is proposed to utilize the accessibility of the skips and cages left hanging on the crawls.

THE VALUE OF PRECIOUS STONES annually produced in the United States from the beginning of this century to 1914 has been about one-third of a million dollars. In 1914 and in every year since, the annual value of the output has dropped considerably, and in 1918 it dropped to $106,523, the lowest reported since the U. S. Geological Survey began to collect statistics of gem production, in 1883, with the single exception of 1896, when it was $97,850. The report on the production of precious stones in 1918, just published by the U. S. Geological Survey, ascribes the decrease in the value of the precious stones produced to the military enlistment of many gem miners, the general scarcity of labor, and the poor market. The output consisted chiefly of the sapphire variety of corundum, which is nearly all used as mechanical bearings in watches and other instruments that require practically non-wearing frictionless bearings. Other less valuable and softer minerals used for this purpose are garnet and some forms of hard compact silica, known as agate and chalcedony. The annual value of the output of the four gem minerals, corundum, quartz, tourmaline, and turquoise, amounts to over four-fifths of the total value of all the precious stones produced in the United States. Montana, Nevada, California, Colorado, Maine, and Arizona are the chief gem-producing States, but from 20 to 30 States annually report some production. Several relatively large diamonds were found in Arkansas in 1918, notably a canary-colored octahedron weighing nearly 18 carats and a number of smaller stones weighing several carats each. The value of all the diamonds produced in the United States, however, in no year exceeds a few thousand dollars.

CONSUL GENERAL ALBERT HALSTEAD reports from Stockholm, Sweden, that the commissioners of the Iron Office complain as to the price of fuel and express anxiety as to the effect of this price on the iron industry. Coal that used to cost 16 crowns per ton delivered at Göteborg now costs 100 crowns.



ORIGINAL REVERBERATORY FURNACE

Reverberatory Furnace Data

From the Smelter Department of the Calumet & Arizona Mining Co., at Douglas, Arizona.

	Furnace No. 2	Furnace No. 4
Date started	Feb. 7, 1918	Jan. 9, 1918
Total days elapsed time to September 1, 1918	206 000	*233 000
Total furnace days (24 hour days in operation)	200 132	223 102
Operating time to total elapsed time, per cent	97 15	95 75
Dry tons sized charge treated per furnace-day	714 7	682 4
Barrels of oil per dry ton of sized charge (gross oil consumed)	0 684	0 692
Tons of liquid converter slag treated per furnace-day	108 8	97 1

*No. 4 down two days on account of holidays

†Includes all oil used for firing-up furnaces.

Average Analyses

	SiO_2	Al_2O_3	FeO	CaO	Cu
	%	%	%	%	%
Slag (includes converter slag)	35.3	7.6	46.2	5.7	0 45
Matte					25.93
Converter slag	21 8	4 5	65 0	0 2	3.06

Estimated average temperature of charge dropped in furnace.. 830°F

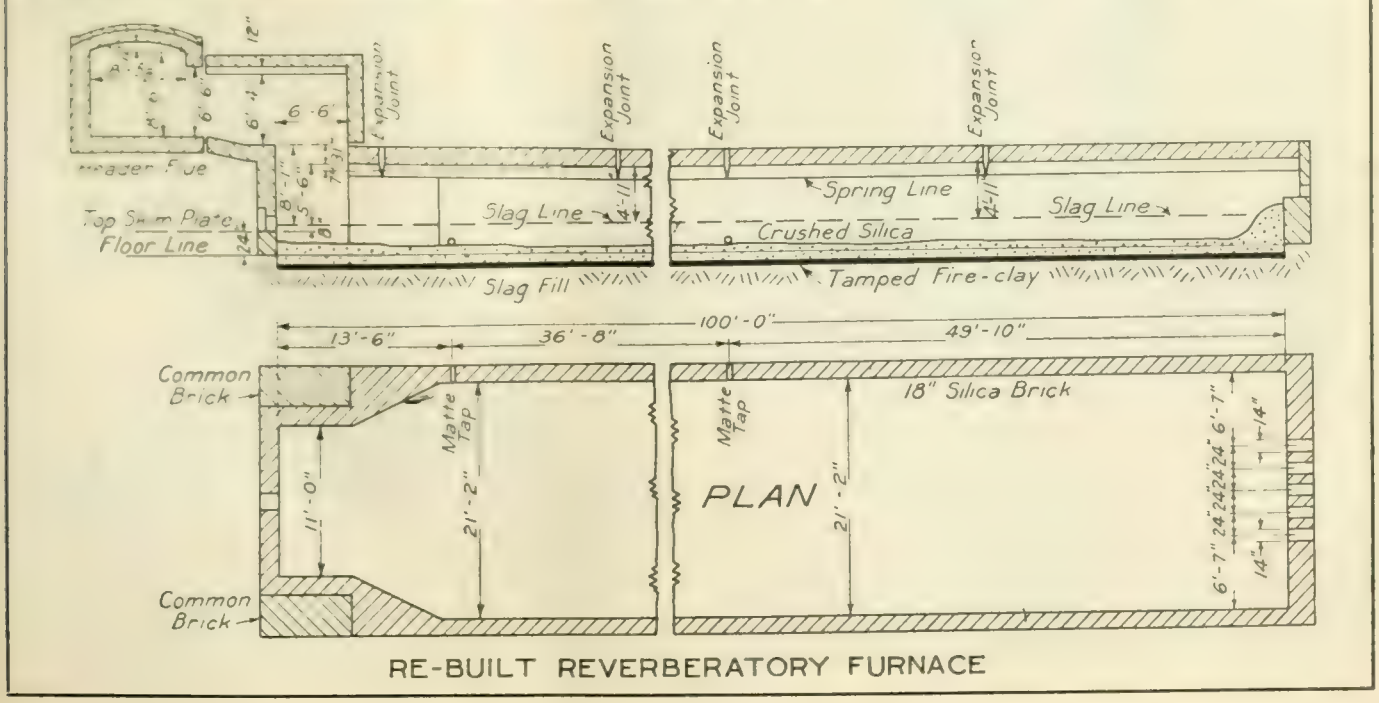
Average draft in uptake (inches of water) 0 19

Screen Analysis of Charge

	%
Reject from ¾ in	3 8
Reject from ½ in	13 0
Reject from ¼ in	21 5
Through ¼ in	61 7

Results of Best 30 Days Continuous Operation

	Furnace No. 2	Furnace No. 4
Dry tons of solid charge treated per furnace-day	794 6	779 6
Barrels of oil per dry ton of solid charge	0 622	0 617



RE-BUILT REVERBERATORY FURNACE

A Step-Bearing for the Wedge Roasting Furnace

STAFF CORRESPONDENCE

The usual conical roller-bearings on which the Wedge furnace-column revolves, have been superseded at Anaconda by a step-bearing, first proposed by J. Kane Murphy, assistant superintendent at the Anaconda reduction works. Fig. 1 shows the old form of construction with conical rollers, and is included for purposes of comparison. This is not the standard method of supporting the Wedge furnace-column, but, as the furnaces equipped in the regular manner were having bearing troubles equal to those supported as shown in Fig. 1, it became imperative to devise some other form of bearing to decrease the interruptions in operation and the numerous repairs. The new bearing is shown in Fig. 2.

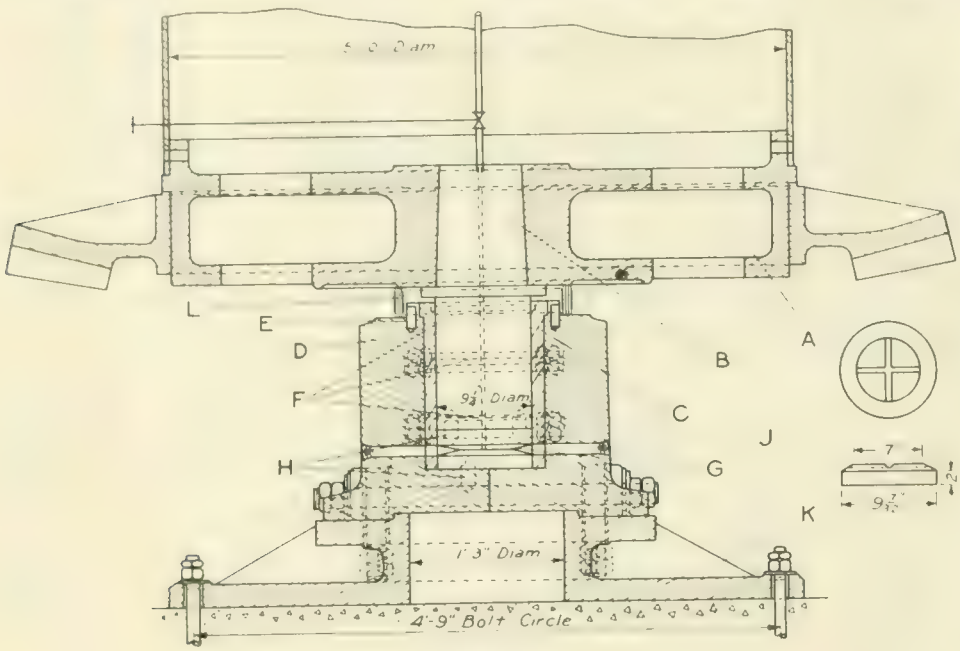


FIG. 2

The central column of the furnace is attached to a hollow casting, *A*, which carries the bevel-gear. This casting fits tightly on the tapered portion of the shaft, *B*, which revolves inside a hard bronze bushing, *C*, made in halves. The bushing is prevented from moving by being pinned to the cast-iron housing, *D*, by pins, *E*. The inside face of the bushing has the usual diagonal oil-grooves, as well as three horizontal grooves, *F*, for collecting any dirt that works down between the shaft and the bushing. The buttons, *G*, are the principal features of the arrangement, and are of Crescent tool-steel, hardened to such a degree that a file will not cut them. They form the actual bearing for the weight of the central column, which is estimated at 80 tons. This gives a pressure on the bearing-surface of 2.08 tons per square inch, a high figure, but possible on account of the slow speed. As can be seen from the detail, the buttons are beveled to present a bearing-surface of 7 in. diameter. The two buttons differ in that the upper one is drilled for the ½-in. oil-pipe which comes down the centre of the shaft, while only the lower button has the oil-grooves as shown. Both buttons are recessed for steel pins, *H*, which serve to hold them fast to the bottom of the shaft and the bottom of the housing respectively. *J* is an oil-drain tapped for pipe and valve.

The housing is made in halves bolted together by 2-in. bolts, and attached to a cast-iron base, *K*, which is bolted to the concrete foundation. By supporting the weight of the central column on jacks, the bearing may be taken apart for examination. At such times, the dirt that has collected in the grooves, *F*, is removed, and the buttons changed if necessary, although these have been lasting over a year, and have given such good service that experiments are being made with bearing-surfaces of less area. A button of 6 in. diameter at the bearing-surface will probably be adopted in future. Lubrication is regulated by a valve controlled from outside the central column, as shown; and there is provided a dust-protecting ring, *L*, consisting of a ⅜-in. layer of canvas clamped between iron rings.

The results obtained by the use of this improved bearing have been very satisfactory, the decrease in the high cost of repairs having more than justified the change, without considering the further decrease in cost because of fewer interruptions than with the old design.

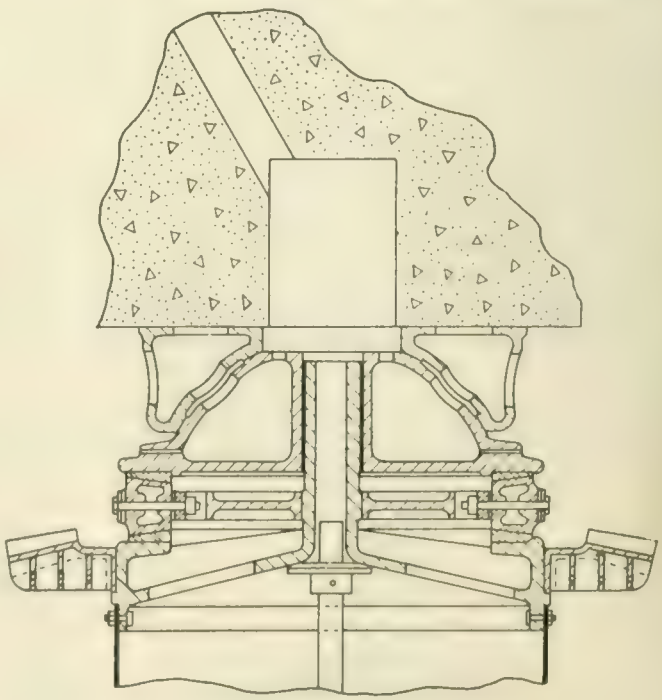


FIG. 1

Coquina: The Shell-Rock of Florida

By WALTER M. BRODIE

The Spaniards settled on the coast of northern Florida and began to form a permanent colony on the site of the City of Saint Augustine in the middle of the 16th century. In 1565 this settlement was already of some importance and building material was in demand. Adobe clay was not to be had, but the shell-rock of Anastacio island was so near at hand that it could be used satisfactorily. The rock, in fact, was so satisfactory for building purposes that the site for Fort San Marco was probably chosen because the coquina rock was found near-by. Coquina therefore has been used as a building material for three centuries and a half, and the old Spanish buildings still standing certify to its lasting qualities.

COQUINA, OR SHELL-ROCK

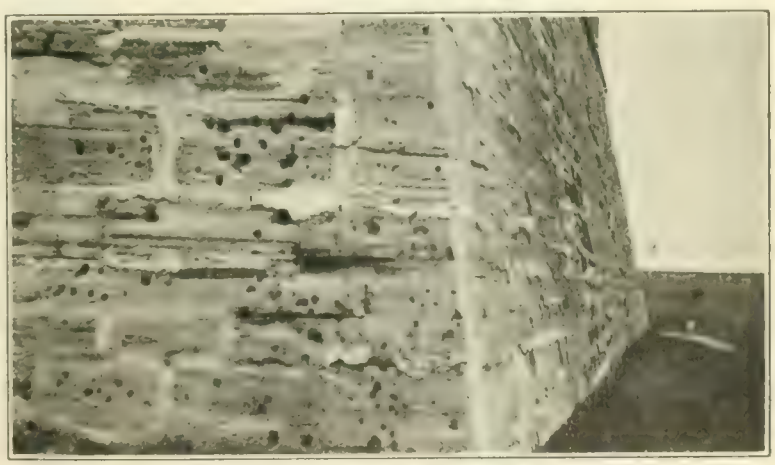
Coquina consists of a mass of shells and fragments of shells, fastened together by a natural calcareous cement. The shells originally accumulated on the beaches and bars, where they were exposed to the action of wave and tide, and where the finer sand was mostly washed away, leaving the shell fragments comparatively clean. Later the land was elevated, probably some 25 or 30 ft., and in the course of time the rain-water, moving slowly down through the layers of shells, and acidulated by carbonic acid and may be by the acid products of vegetal decomposition, carried enough lime carbonate to form, after evaporation, the material required to cement the shells. Between the shell fragments there generally is some sand, which in course of time may have helped to strengthen the bond. When coquina rock is broken or crushed, a considerable quantity of silicious sand can generally be sifted out.

In some places the shells are very firmly cemented; in other places they are not cemented at all; therefore the Spaniards had to go to considerable trouble to find the harder and more resistant layers for use in their constructions. The rock had the great advantage that on exposure to the weather it did not deteriorate; in fact, on drying the rock hardens and when built into walls in the course of years the bond stiffens. Well-jointed blocks in old structures are now found to be tightly cemented.

This coquina, together with the shell-marls of Florida, is labeled Pleistocene. In 1824 Thomas Say reported upon the shells contained in the Saint Augustine shell deposits and in 1908 a collection of the invertebrates of the shell-marls of Florida was made by the Florida State Geological Survey and the U. S. Geological Survey. A list of these invertebrates of Pleistocene age is found on page 151 of the Second Annual Report of the Florida Geological Survey.

The shell-marls of Florida form a continuous bed along the coast and reach many miles inland. The thickness of the Pleistocene is reported to be 66-68 ft. at Ormond and about 70 ft. at West Palm Beach, but the solidified layers of coquina building-stone in the neighborhood of Saint Augustine have only been found, it seems, above the present water-level.

The coquina occurs along the coast south from St. Augustine for a long distance and the sand-dunes indicate where it may be found. These sand-dunes are not always near the beach. Near Daytona and Titusville they are found a couple of miles inland. On Anastacio island, however, the coquina reaches out into the ocean.



A CORNER OF FORT MARION, SHOWING BULLET-MARKS

The hard shell-rock occurs in strata irregularly alternating with softer layers of shell and sand. Hatchets and axes were used in trimming the stones, which, however, were hard and solid enough to stand rough handling. In the sea-wall of St. Augustine many blocks can be seen which measure 4½ by 3 by 2½ ft., and the fact

that they were quarried, hauled by teams to the Matanzas river, shipped in boats, and unshipped near the work proves that they had considerable resistance. The walls of the old Spanish fort, San Marco, now called Fort Marion, and the sea-wall of St. Augustine show that the coquina rock stands the climate of northern Florida wonderfully well. Still, the rock is not hard and the bonding cement between the shell fragments is often hardly noticeable. One wall of the fort, where prisoners sometimes were released from captivity, shows that coquina walls were not very well adapted for the purpose, as they show the bullet marks much deeper than adobe walls would.

The coquino, however, though it can be worn by abrasion, is affected very little by wind and water. There are names and dates cut in the rock, where the tides wash it, that are 35 and 40 years old, and that can still be deciphered. Still, the rock is soft enough for the building-blocks to be rubbed smooth and true with a rubbing-stone, or to be cleaned and re-faced by rubbing off the surface.

As a natural building rock, this coquina is probably now a thing of the past. Today it is cheaper to use the loose shell deposits that are found close to transportation and to bond this material into blocks with sand and Portland cement, than it is to explore for harder layers, to cut the blocks, and to carry them to railway. The coquina rock, however, will always have a historic interest and remain a monument to Spanish enterprise, intelligence, and thoroughness in colonization.

MINING is a most important industry throughout Siberia. The supply of machinery and equipment for the carrying on and extension of this industry must continue to be a trade of considerable proportions. The deposits of gold, silver, lead, zinc, and copper have been energetically developed, mainly with British capital, in the Ural mountains, the Kirghiz steppes, and the Altai mountains, and in central and eastern Siberia. Placer mining is carried on throughout central and eastern Siberia, the fields of the Lena river and the Amur district being especially important. Coal is found in various parts of the country, and the rise in the price of wood has led to the exploitation of the mid-Siberian fields. Rich coal beds exist on the island of Sakhalin and along the Pacific coast. Deposits of iron ore are found near the coalfields in the mountainous districts, but are waiting proper transportation facilities for their profitable exploitation.

THE U. S. GEOLOGICAL SURVEY now has ready for distribution its annual statement on the sand-lime brick industry in 1918. This report contains statistics of the production of sand-lime brick since the beginning of the industry in the United States, in 1903. It also contains information of interest to those engaged in the building industries and in the manufacture of building brick. A copy of the report may be obtained by application to the Director, U. S. Geological Survey, Washington, D. C.

Amendments to Compensation Laws

On July 22, 1919, the amendments to the Workmen's Compensation, Insurance, and Safety Act, as adopted by the last Legislature of California became effective. The Industrial Accident Commission has prepared a summary of these amendments. Seventeen changes were made in the Act. The waiting period was reduced from ten days to seven days. Compensation will be payable to the injured man on the eighth day after he leaves work as the result of an industrial injury. When an employee under 16 years of age is injured, it shall be the presumption that such injury was not caused by serious and wilful misconduct. Serious and wilful misconduct cannot be charged against the injured employee by the employer if the injury is caused by the failure of the employer to comply with any provision of law or any safety order of the commission with reference to the safety of places of employment. In claims of serious and wilful misconduct made against the employer, the general superintendent is made responsible for the corporation, as well as the executive or managing officer. Non-resident aliens are required to prove their dependency and cannot be conclusively presumed to be dependent. Applications for adjustment of controversies may be filed with the Industrial Accident Commission by the attorney or other representative of an injured employee, if authorized to do so in writing. A lien against compensation will be permitted for the support of dependents, as well as for the living expenses of the employee. Self-insurers shall not be required to pay any sums into the State Compensation Insurance Fund to cover liability for compensation, excepting in life-pension cases. It is a misdemeanor not to report forthwith a fatal industrial injury, by either telephone or telegraph, to the Industrial Accident Commission. An injunction may be issued against an unsafe place of employment if it constitutes a serious menace to employees, provided that such application for an injunction comes from the Industrial Accident Commission or a member of the Commission. The Commission is authorized to tag dangerous machinery and the use of such machinery is prohibited until the tag is removed by an authorized representative of the Commission.

Chapter 183 creates a liability on the part of the employers or their insurance carriers, in addition to any liability heretofore fixed by law, in case of the death of an employee who leaves no dependents. Under such conditions it is required that a death benefit of $350 be paid and the Industrial Accident Commission is authorized to draw upon the fund created for the promotion of re-education and rehabilitation of persons disabled in industry in California. This new law was passed in response to a public demand that crippled men be aided in acquiring new occupations. It will reduce dependency and prove of material benefit to the citizens of the State.

IN 1918 ten Utah shippers produced 5100 gross tons of ore, containing 35% or more manganese.

American Potash

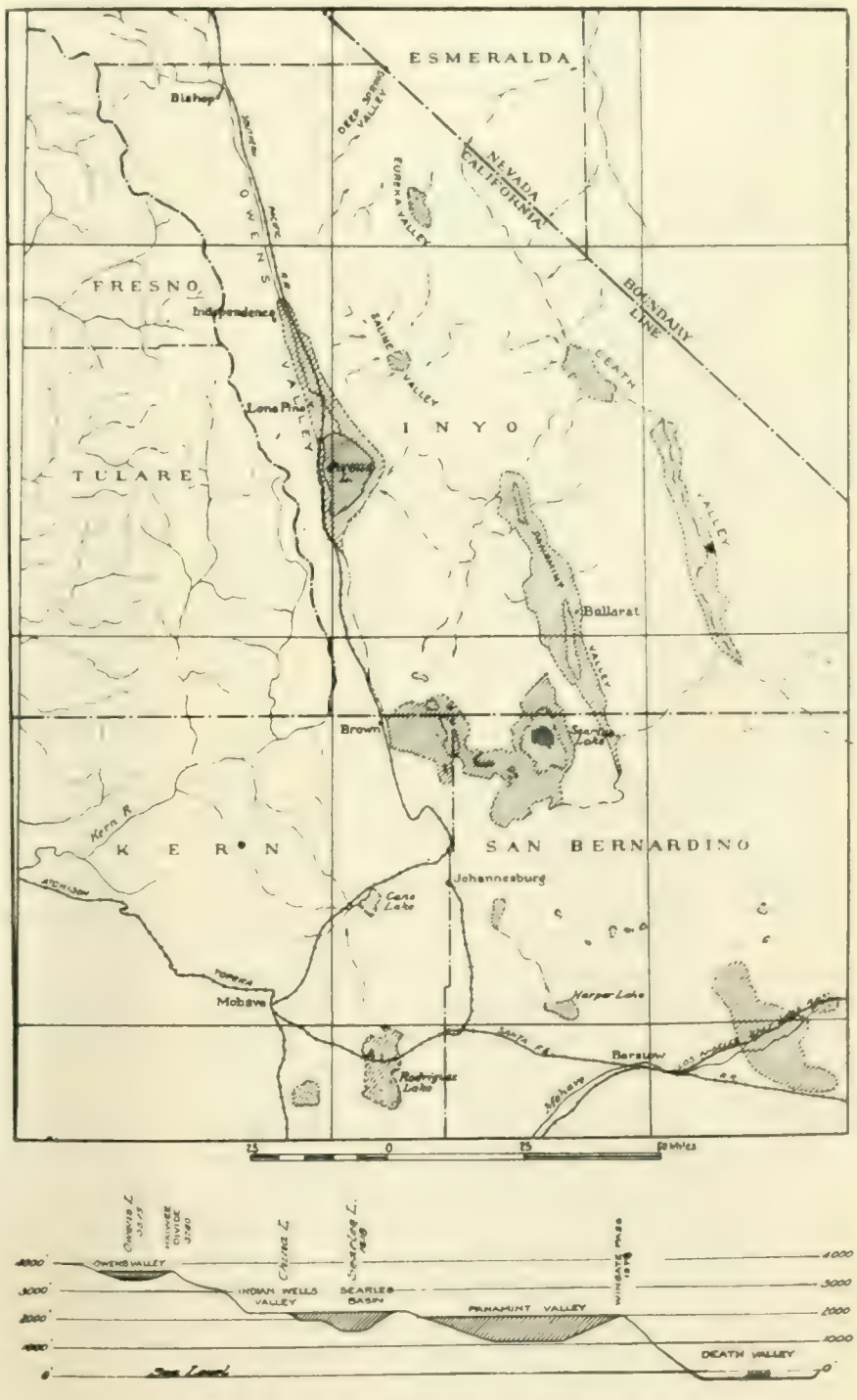
By HERBERT H. ROE

Will America's new potash industry, which served so well during the emergency of war, be able to retain and develop its economic position if confronted by European competition, or shall we soon become dependent again upon foreign nations for our supply of this product?

Under the stimulus of a demand created by the War, the United States in 1917 exceeded its output of the preceding year by over 300%, producing 32,366 tons to the value of $13,791,922 at prices then averaging as high as $426 per ton of pure potash, or K_2O. From further statistics recently issued by the U. S. Department of the Interior, the figures for 1918, practically complete, show a gratifying increase to 52,135 tons of potash produced.[1]

If our own potash industry is to become established, it must be protected and fostered by the Government at least until such time as it can develop sufficient strength to compete with established industry abroad. The menace can be discerned too plainly already, for a recent Boston report states that French agents are even now quoting on potash from the deposits in the re-occupied Alsatian territory at prices ranging from $12 to $40 per ton. The latter approximates the rate European potash commanded in this country prior to the War, up to which time almost our entire supply was derived from Germany. During the year 1913 alone we imported in excess of one-quarter of a million tons of potash, our own production amounting to less than a thousand tons.

The famous potash deposits of Strassfurt, reputed to contain 20,000,000 tons of crude salts, have in the past been mined largely for the benefit of the Imperial German government by the Deutsche Kaliwerke (better known by its propaganda in America as the German Kali Syndicate), and in pre-war days could boast a pay-roll of 25,000, furnishing practically the world's entire demands. From official statistics it has been estimated that before the War the more efficient German mines—and there were altogether about one hundred operating under government control—could produce potassium chloride with



MAP OF PART OF CALIFORNIA. AFTER U. S. G. S.

[1]This confirms the forecast made by Herbert Lang in his article entitled 'The American Supply of Potash', which appeared in the M. & S. P. of Jan. 4, 1919.

a guarantee of 50% K_2O for $15.54 per ton at a point of production, or at a net cost of $20.40 per ton landed at Atlantic ports.[2] On the other hand, it is claimed by the Société de Chimie Indûstrielle that the vast potash beds near Mulhouse, in Upper Alsace, contain 1,472,058,000 tons of material averaging 22% K_2O, which represents more than 300 million tons of pure potash. Although the grade of salts surpasses that of any other known deposits, it is nevertheless a fact that shipments of potash from Alsace in the past were restricted to 5% of German's total output. Less important deposits of foreign potash, mainly of the rock type, are found in Spain, Italy, Abyssinia, Hungary, Turkey, and Australia.

When the importation of German potash practically ceased on the outbreak of the War in August 1914, the stocks on hand in this country rapidly increased in price, and as this was coupled with an inadequate supply, many vital industries were either crippled or seriously hampered in their operations. The United States government, however, had not been entirely unprepared, for as early as 1912 the Geological Survey and the Bureau of Soils conducted an organized investigation throughout the United States with the object of classifying our potash resources and of stimulating their development.

In reviewing briefly the achievements of the past year, attention should first be given the following summarized Government statistics covering our domestic production during 1918, these figures being complete except for reports from some of the smaller producers:

Sources	Number of producers	Total production short tons	Available potash short tons
Natural brines	21	147,125	39,255
Alunite	4	6,073	2,619
Dust from cement-mills	9	11,739	1,429
Kelp	6	14,456	4,292
Molasses distillery waste	4	9,505	3,322
Steffens waste water	5	2,818	761
Wood ashes	26	609	365
Other sources	3	262	92
Total	78	192,587	52,135

Incidentally, the term 'potash' as generally used, includes all potassium salts, of which the most important commercially are the chloride (muriate), the sulphate, the carbonate, and the nitrate. Since the potassium content in these compounds differs, the trade has adopted potassium oxide (K_2O), known as 'pure potash', as the standard unit of measurement, each compound therefore being valued according to the amount of K_2O contained. America's varied sources of potash salts include saline deposits, brines, natural and artificial bitterns, alunite and feldspar rocks of different kinds, residues, wastes from cement-plants, distilleries, and sugar-mills, and organic materials such as wood-ash, kelp, sugar-beet, and other plants. Potash salts are consumed mainly in the manufacture of fertilizer; they are used also in metallurgy, electroplating, photography, the match, soap, laundry, glass, tanning, and dyeing industries, and for certain medicinal and chemical purposes, and in the manufacture of potash alum, electro-chemicals, and pyrotechnic mixtures. From statistics compiled by the U. S. Bureau of Mines it is shown that 90% of all the potash produced or imported is used for fertilizers and most of the remainder for explosives, high-grade glass, and the chemical industry.

[2] 'Our Natural Resources of Potash', by Frederick W. Brown. M. & S. P., Dec. 7, 1918.

Natural Brines: It will be observed that three-quarters of our domestic potash supply was secured last year from natural brines, the Sand Hills lakes in western Nebraska notably contributing in excess of one-half of the grand total shown. Later reports indicate that production from this alkaline source was increased to nearly 140 tons per day, an amount which approximates the entire output of the United States during the year now under review. The more famous deposits of Searles Lake, in southern California, will be dealt with subsequently in this article.

Alunite: The best-known deposits of this mineral have been under development for some time past near Marysvale, Utah, where about 10 tons per day has been produced. It has been demonstrated that as a medium for fertilizer it is possible to increase soil production by 40%. Many millions of tons of potash can undoubtedly be profitably secured from this source if the aluminum, as well as the potassium content, can be commercially utilized.

Dust From Cement-Mills: It was stated in 1917 that the total potash escaping every year from all the cement-plants in this country amounted to about 100,000 tons, and that if cement-kiln practice were standardized so that 85% of the potash could be volatilized, the potash so produced would approach 200,000 tons annually.[3] There is little doubt but that potash thus recovered as a by-product holds great promise for a production that may be maintained even in the face of future competition. The same holds true in the case of blast-furnace waste-dusts and gases.

Kelp: Owing to prohibitive treatment charges this branch of the industry, which during the first half of 1918 furnished about 11% of our production during that period, failed to survive a reduction in the high war-prices and can probably not be depended upon as a future source of potash supply. It is equally unlikely that any action will be taken to carry out the proposal of transplanting areas of Californian kelp to the Atlantic seaboard, although the cost of production would thus be greatly reduced nearer the centres of demand on account of the elimination of high freight-charges.

Molasses Distillery-Waste: The potash residue derived as a by-product from molasses that has been fermented and distilled in the manufacture of industrial alcohol, provides a source of potash that can be expected to continue only as long as the returns cover the cost of concentrating and drying the waste-liquors.

Miscellaneous: In connection with the less important sources of our domestic supply it should at least be men-

[3] W. H. Ross, U. S. Bureau of Soils, p. 290, Vol. LVI, Trans. A. I. M. E.

tioned that the treatment of wool-waste, the leaching of wood-ash, and Steffens water of beet-sugar manufacture, have contributed an acceptable, though comparatively small, tonnage of fertilizer potash. Other potential resources awaiting further development are the potash-bearing silicates, particularly the leucite rock (silicate of alumina and potash) of Wyoming, the greensands of New Jersey and elsewhere, and the potash-rich slates of Georgia, such as are found also in other parts of the country. The utilization of our vast reserves of these raw materials necessarily depends on the operation of processes sufficiently economical to allow of production in competition with potash from other and foreign sources.

As to the production capacity of our potash plants, classified according to sources of raw materials, the U. S. Geological Survey roughly estimates the same as follows:

Source	Available potash (K_2O) short tons
Natural brines:	
Nebraska lakes	50 000
Other sources	28 000
Alunite	4 000
Dust from cement mills	3 500
Kelp	5 500
Molasses distillery waste	4 000
Steffens waste water	3 000
Wood-ashes	1,000
Other sources	1 000
Total	100,000

This grand total corresponds to more than 40% of our normal consumption and gives an indication of the future expansive possibilities.

So much comment has been circulated in the past anent the potassium and borax deposits at Searles Lake, California, that at this juncture it may not be inopportune to present a review of activities of the pioneer company operating in that field, together with photographs to illustrate various phases of the operations. Searles basin, flanked by the Argus and Slate ranges, is situated at an altitude of over 1600 ft. in the northwestern corner of San Bernardino county, scarcely 50 miles from the famous Death Valley. The productive possibilities of Searles Lake—or Borax Flat, as this branch of the Mojave desert has often been termed—were first recognized by the late John W. Searles, who, after discovering the deposit in 1862, finally located on 2080 acres in February 1873. This deposit was profitably worked for many years by Searles, but when the price of borax receded to $60 or $70 per ton, he was obliged to dispose of his holdings in 1895 to the Pacific Coast Borax Co. It was not until the year 1912, however, that the importance of the potassium in the deposit was appreciated. Following exhaustive experiments confirming the potentiality of Searles Lake as an inexhaustible source of potash, the American Trona Corporation was organized in New York and floated in 1913 with an authorized capital of $12,500,000. The Trona Railway Co. was then formed, all the capital stock being owned by the parent company, and a standard-gauge railroad of 30.7 miles was constructed from Searles, on the Southern Pacific Mojave-Owenyo line, to Trona, the company's headquarters on the lake. The buildings of the old company formed the nucleus of the American Trona Corporation's experimental plant, and after many trying months of pioneer research a sufficiently promising process was evolved for the extraction of potash and other salts to justify the construction of the initial unit of the permanent concentrating plant, the completion and successful operation of which unit marked the entry of the American Trona Corporation into the field of production in November 1916. The close of that year witnessed the final attempt on the part of the Lee interests to forcibly dispossess the California Trona Company of its rightful claim-holdings. In the following year the State Supreme Court handed down its decision ratifying the company's property rights at the lake, thus bringing to a close the bitter contention which had waged for several years and which had been the subject of so many sensational newspaper reports. During the experimental stage and during the period of early construction the company further developed its resources of fresh water, and at the present writing has an ample supply assured for its future plant and domestic requirements. Horizontal beaches and shore markings over the more rocky portions of the surrounding mountain slopes present unquestionable evidence that in prehistoric times the level of the lake stood no less than 600 ft. higher than today, which explains the highly concentrated state of the present formation as being due to the process of solar evaporation through a long period of time. The area of Searles lake at its greatest expansion during past ages was about 385 square miles, including the extensions into the adjacent Salt Wells and Indian Wells valleys. The magnificent deposit of white crystalline salts now remaining is nearly 12 square miles in area and has a depth of between 60 and 100 ft. through the salt body to the lake's muddy bottom, having been estimated to contain a minimum of 4,000,000 tons of potash as well as larger quantities of borax and other salts. From any point over the expansive area of the so-called crystal body a shallow well can tap an inexhaustible supply of the mother-liquor, which entirely permeates the deposit. A representative analysis of this brine, having a specific gravity of 1.3 at 23° C., will show the following:

	Per 1000 cc Grammes	In original sample %
Insoluble in water	262	20.15
Sodium sulphate, anhydrous (Na_2SO_4)	71	5.46
Sodium carbonate, anhydrous (Na_2CO_3)	60	4.62
Sodium bicarbonate	trace	...
Sodium biborate, anhydrous ($Na_2B_4O_7$)	17.2	1.32
Potassium chloride	58.4	4.50
Total		36.05

*Quoted by Hoyt S. Gale in U. S. Geological Survey Bulletin No. 580, Salines in Southeastern California, at 36.9 gm K_2O in 1000 cc of original solution, or 5.84% KCL.

During pumping operations at the lake extending over two years but slight variations have been observed in the successive analyses. By comparison it is interesting to note that the salts contained in the Great Salt lake, in Utah, carry less than 2% potash, while the salts of Owens lake, in California, contain approximately 2.25% potash, according to E. E. Free in his Bulletin No. 54, entitled 'The Topographic Features of the Desert Basins of the United States with Reference to the Possible Occurrence

of Potash', issued by the U. S. Department of Agriculture.

One of the several important problems without precedent successfully solved by the American Trona Corporation was the efficient delivery of brine from the centre of the lake to the plant on its western shore, a distance of nearly four miles. A road-bed of imported local material and a narrow-gauge track were first built across the crystal body to the site of the pump-house, which was made of reinforced concrete and equipped with electrically driven centrifugal pumps and relays, each capable of throwing the heavy brine, which weighs 10¾ lb. per gal., at the rate of 500 gal. per minute. With the drilling of a series of manifold suction-wells on laterals east and west of the pump-house and the construction of a 10-in. line to the concentrating plant, which pipe-lines were thoroughly insulated with hair and wool-felt covering, it has been possible to deliver the brine with the variation of but a degree or two and without precipitating the salts, even though the thermometer shade-readings fluctuate 100° throughout the year.

Mention should here be made of the 'reef' of trona ($Na_2CO_3.NaHCO_3.2H_2O$) lying along the eastern and north-eastern shores of the lake and constituting certainly one of the most massive deposits of its character ever discovered. This reef of natural carbonate of soda is in the nature of a saline efflorescence, being composed of salts brought up with rising ground-water and deposited at the surface by evaporation. A considerable tonnage of this crude material has already been shipped out for various uses, including the manufacture of explosives. In addition to the minerals before-mentioned, the following are also to be found in the Searles Lake deposits—a veritable treasure-house of minerals—being arranged approximately in order of abundance: halite, mirabilite, thenardite, natron, gypsum, anhydrite, glauberite, hanksite, northupite, pirssonite, gaylussite, sulphohalite, tychite, and searlesite. Several other minerals have been said to be present, including celestite, cerargyrite, colemanite, dolomite, embolite, gold, nitre, and sulphur.

Dr. H. W. Morse, the company's technical executive, in a recent address before the members of the American Chemical Society at the Engineers' Club in San Francisco, spoke optimistically of the future. He claims that by further simplification of the process at Trona and the introduction of solar evaporation, the American Trona Corporation can successfully operate on pre-war prices. Production was speeded up to 2000 tons of K_2O per month. Borax, also occurring with potassium and other salts in solution in the brine of Searles lake, offers a promising source of revenue which the company plans to develop.

The Solvay Process Co. has also been successfully producing potash for some months past from its reduction works at Borosolvay, on the lake shore, two miles from Trona and served by the Trona railway. Elsewhere on Searles lake a number of new plants have been planned to operate the Government grants made under the potash-leasing law enacted October 2, 1917, the latest in the field being the West End Consolidated Mining Co. of which the famous F. M. ('Borax') Smith is president.

It is not within the scope of this article to enter into further discussion on the many sources of American potash supply, but judging from the results so far attained during the past five years and the future possibilities, it is reasonable to believe that the United States has within its borders potassium salts in sundry forms sufficient for all future requirements. Nevertheless, if the 1913 importation of 270,000 tons of potash can be accepted as a criterion of America's normal minimum consumption, it is evident that our present internal sources of supply will, for some time to come, be inadequate to furnish the expected growing demand. It should be noted, also, that owing to the high cost of producing American potash, prices have necessarily maintained a high level. Liberal stocks continue on hand throughout the United States, naturally, because the consumer is marking time pending governmental action.

President Wilson, in replying from Paris recently to a request that action be taken to limit the importation of German potash into this country, advised Senator Hitchcock of Nebraska of his doubt that any restrictive measures could be made effective without further action by Congress, adding that potash was one of the commodities the Allies had already seen fit to permit Germany to export in payment for food. All the more opportune is the bill, which will have the support of the Departments of War and Agriculture, now pending for decision by Congress. This measure by Mr. Franklin K. Lane, the Secretary of the Interior, failed to be considered at the last session of the 65th Congress; it proposes to restrain the importation of foreign potash with the proviso that it only be used in certain fixed proportion with our own domestic product. Preparatory to the campaign in Congress, it is interesting to note that headquarters have been established at Washington by the U. S. Potash Producers' Association, recently organized in Denver under the presidency of Mr. Boyer of Salt Lake City.

Now, with the advent of peace, keen competition should be expected not only from France, but also from Germany again, where vast quantities of potash are ready for shipment. The problem therefore facing Congress is the determination of the policy necessary to be pursued for the proper protection of this vital industry of ours, in order that America may be enabled to further develop her own resources and finally become completely independent of foreign supply.

NEVER have labor conditions in Alaska been more unsettled than at present, not that there is a scarcity of men numerically but that many of them are not disposed to work. All the large quartz-mine operators are short of men—practical underground miners—and the output is greatly curtailed in consequence. The same may be said of the placer districts of the interior, except that there are at present but few laborers in the interior camps. As a result the mineral output of Alaska for the present year will not be much in excess of that during either of the war period seasons.

OLD PLANT OF THE AMERICAN TRONA CORPORATION ON SEARLES LAKE

POTASH PLANT OF THE AMERICAN TRONA CORPORATION AT TRONA

A SURFICIAL MASS OF TRONA, THE NATURAL CARBONATE OF SODA, ON SEARLES LAKE

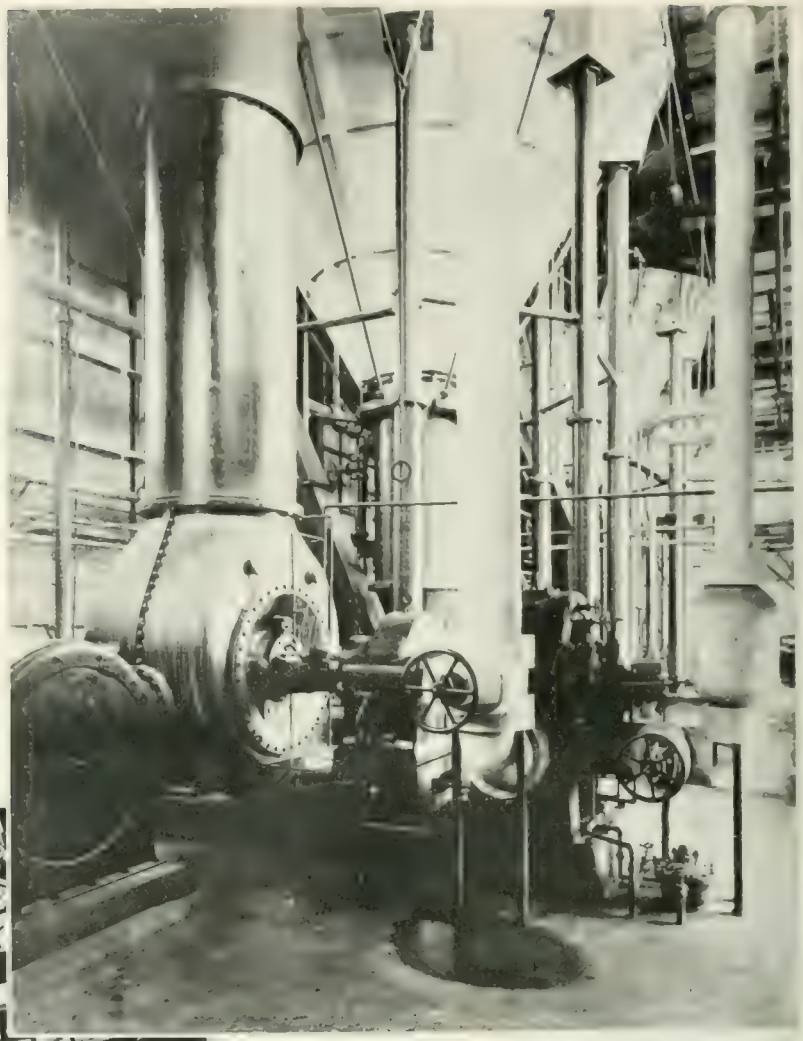
CLUB-HOUSE AND DORMITORIES AT TRONA

POTASH PLANT OF THE SOLVAY PROCESS, AT BOROSOLVAY, WITH TRONA IN THE DISTANCE

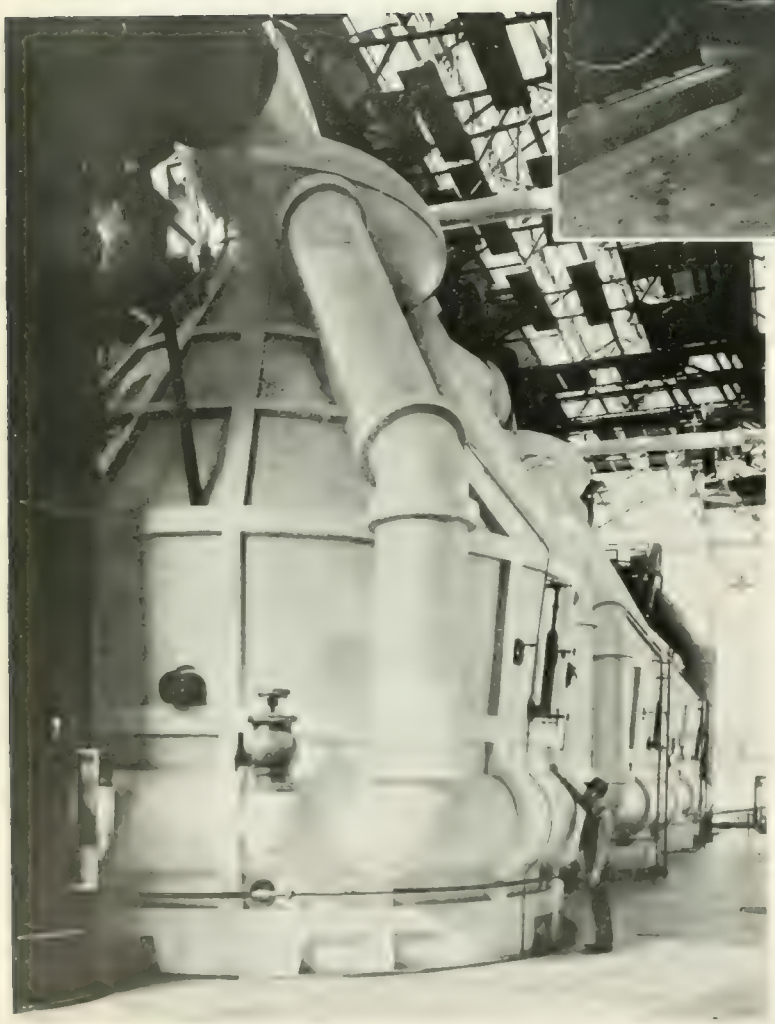
THE SOLVAY PROCESS PLANT AT SEARLES LAKE

MAIN PIPE LINE FOR BRINE AND ROAD ON SALT DEPOSIT AFTER A RAINSTORM

ROAD MACHINE SCRAPING SURFACE SALT ON SEARLES LAKE



LOWER FLOOR OF EVAPORATOR-HOUSE AT TRONA



THE TRIPLE VACUUM-PANS IN THE EVAPORATION PLANT

Roasting by the Huntington-Heberlein Process at Cockle Creek, N. S. W.

By W. L. JACKSON

*All ores containing more than 3% sulphur, together with all sands and other fine residues, are delivered to the roasting department. Those that are in a coarse condition are first sent to the crushing plant, consisting of 15 by 9-in. jaw-crushers and two No. 5 Krupp mills. The ore is here crushed through a quarter-inch screen. Any pyritic concentrate high in sulphur is given a preliminary roasting, to bring the sulphur content down to about 12%, and the roasted material is delivered to the H. H. charge-making bins. Here the various ores, sands, residues, roasted pyrite, together with about 12% of limestone, are made up into one-ton charges in hopper-trucks with bottom-discharge. The trucks are elevated by hydraulic lifts to a tramway running over the roasting-furnaces, and the contents are dropped into hoppers over each furnace, from whence the mixture is fed into the centre of each furnace by means of a Challenge ore-feeder.

A typical charge would contain:

	%
Pb	50
SiO_2	7
FeO	7.5
CaO	6
MnO	2.3
ZnO	10
S	15

The mixture is now given a roasting in a modified Godfrey furnace, which brings the sulphur content down to about 9.5%. This furnace is gas-fired, and consists of a rotating circular hearth, 21 ft. in diameter, supported on a wheel-race, and covered by a low dome-shaped roof. The charge, as already stated, is fed into the centre of the furnace through a hopper with a Challenge feed, and worked outward by blades attached to a fixed radial arm. At each revolution it is turned over and outward, the amount of deflection of the blades, which are adjustable, and the rate of rotation of the hearth determining the output of the furnace.

There are ten of these furnaces in two rows of five, each with an output of 30 tons per 24 hours. They are driven by a duplicate steam-engine of 18 hp. (which allows of great variation of speed) off two main shafts by belt-drives, each furnace requiring about 2½ hp. One man looks after four furnaces. The object of the roasting in these furnaces is not only to reduce the sulphur content down to about 9.5%, but also to agglomerate the fine particles so that the roasted material will be in a granular condition, which form is most suitable for the subsequent treatment in the H. H. pots.

The gas for firing the roasters comes direct from the Mond gas-plant, and is led into the brick combustion-chamber of the furnaces through a gas-burner, which consists of a cast-iron box through which a number of air-pipes pass. The gas and air thus become mixed as they pass into the combustion-chamber. Fitted to the front of the box is a wrought-iron sliding plate, perforated with a number of holes coinciding with the air-pipes leading through the box. As the sliding plate is worked backward or forward it opens or closes the air-holes, thus regulating the supply of air to the combustion-chamber. The supply of gas is controlled by a gate-valve on top of the cast-iron box or burner.

The hot roasted ore is discharged at the periphery of the hearth into brick-lined boxes, which keep the material hot while sufficient is accumulating to fill one of the trucks, by which the roasted ore is conveyed to the H. H. pot-house. When sufficient ore has accumulated in the various boxes to make up a train-load, it is allowed to drop out of the hoppers into special side-tipping trucks, run on a 2-ft. gauge tram-line. These trucks are pushed out onto the main line, where they couple together automatically, and are hauled by a 5-ton electric locomotive up a 4% incline into the H. H. pot-house. This plant consists of 24 pots, each capable of holding 5 tons. The charge-floor is built up level with the top of the pots, which facilitates charging.

The H. H. pots are of cast-iron and of elliptical form, hung on hollow trunnions. About six inches from the bottom a perforated plate fits horizontally. This is held in position by four studs, which are fixed into the sides of the pot, and project about an inch over the top of the plate. The space under the plate acts as a wind-box. The air-blast passes through the hollow trunnion, down a pipe outside of the pot, and enters the wind-box. There is, therefore, no necessity for detaching and re-attaching the air pipe after each tipping of the pot.

A hood rests on the flanged edge of the pot, making a fairly close joint, which is made air-tight by a lute consisting of flue-dust and clay. It is provided with two small doors or inspection-holes, through which the charge is barred when blow-holes make their appearance. They are also fitted with a telescopic arrangement, which allows the hoods to be easily swung up during charging or tipping operations. The hot roasted ore is tipped direct into the pots. The charge is levelled, and an air-blast of from 10 to 12-oz. pressure is turned on. Thermo-chemical action takes place: the ore being desulphurized to a low

*From the Transactions of the Australasian Institute of Mining Engineers.

point, and the heat generated by the reaction is sufficient to fuse or sinter the mass, with the exception of a little fine on the top of the pot; this is returned to the raw mixture, and worked off in small amounts to each charge. It takes from six to eight hours to finish the operation. The pot is then turned over, and the sintered mass falls onto the breaking-floor beneath, where it is cooled by spraying with water, and broken up to six-inch lumps. One essential difference in the process to the general practice is that the charge, after roasting, is not wetted and cooled, but arrives at the H. H. pots at a dull-red heat. No fire is built in the pot, the heat retained by the ore being sufficient to start the reaction when the blast is turned on, whereby there is a considerable saving in fuel and labor.

The gas-pipes from the hoods connect with four main overhead pipes, two of which convey the gas suitable for acid-making to the acid-chambers. The other two are used for by-passing the unsuitable gases to two iron stacks, which discharge into the atmosphere. As the operation develops, it is expected that the whole of the gases will be used for acid-making, about 80% of the gases being serviceable for this purpose.

To one trunnion of each pot is fitted a wheel about four feet in diameter, which has a heavy toothed boss. These teeth engage with a pawl, which holds the pot in position while working. When it is ready to tip, the pawl is knocked out, a chain is passed round the wheel, and the pot pulled over by means of a two-ton block-and-tackle. The sintered mass, weighing about four tons, falls onto the breaking-floor, 10 ft. below. This floor, which stands about four feet above the surrounding level, has been built up by running in molten slag to a depth of six feet. The block has been covered with concrete, reinforced with 60-lb. railway irons laid side by side. These overhang by about one foot, and project just over the top of the side-tipping trucks, which stands on a line running each side of the breaking-floor. This, together with the fact that the floor has a slight fall to each side, enables the sintered product to be easily pushed into the charge-trucks. When full they are drawn away to the smelters by the five-ton electric locomotive already mentioned.

The blast for the H. H. pots is supplied through a 20-in. main from a Root blower, driven by a 60-hp. variable-speed motor, the actual power required being about 30 horse-power.

Throughout the recent disturbances in Mexico the American Smelting & Refining Co. was able to maintain four of its furnaces in operation at Chihuahua. This was possible through the existence of about a month's supply of ore in the bins. Mining as well as smelting operations have been kept up to some degree, but are expected soon to show an increase. An option was recently given an oil-driller who had visions of a flow on part of the acreage which the company owns at its El Paso smelting plant. The drilling was not finished within the time named in the option and it was not renewed. There have been no evidences of oil on any of the 8000 acres of the American Smelting & Refining Co. in Texas, although some of the more enthusiastic men in the oil-drilling business have considered it logical that oil would be found. Further drilling may be done for company account.

Asphalt in 1917 and 1918

According to statistics compiled by the U. S. Geological Survey, the quantity of asphalt and allied substances produced in the United States in 1918 was 1,237,853 short tons, valued at $18,540,032. Although the demand for imported native asphalt is still large, the relative abundance and adaptability of petroleum has reduced considerably the production of native bitumens and bituminous rock from domestic quarries. However, the increased price received by producers of domestic native bitumens more than offsets the decline in output. The quantity of petroleum asphalt (including road oil and flux) produced in 1918 from oil of domestic origin was 527,575 short tons, vlaued at $7,435,204. The native bitumens and allied substances, including gilsonite, grahamite, elaterite, bituminous rock, and ozokerite produced from mines and quarries in the United States in 1918 was 60,034 short tons, valued at $780,808. Asphalt is widely known and has long been extensively used in road construction, but in recent years many producers of asphalt and allied substances have successfully marketed their products for other uses. Including both native asphalt and asphalt made from petroleum, as well as gilsonite, grahamite, and elaterite, the uses in buildings and other structures are manifold. As they are elastic, antiseptic, acid-resistant, and moisture proof, these materials are being widely employed for use in flooring and roofing, in waterproof coating, and in electric insulation, as well as in the manufacture of varnish, paint, and putty. Although they have been marketed for relatively few years they are in general demand among contractors and engineers and their use is rapidly increasing. Gilsonite, the purest known hydro-carbon, has found great favor in the rubber industry. As pure rubber is sensitive to heat and cold it cannot be used advantageously for making products that are exposed to extreme temperatures, but when it is mixed with gilsonite and the mixture is vulcanized the rubber undergoes changes in composition that enable it to resist variations in temperature as well as oxidation. The product of this mixture, which is called mineral rubber, is well adapted to outdoor use, and the demand for it is increasing. Ozokerite, a native paraffin, is utilized in the manufacture of leather polish, sealing wax, electrotypers' wax, candles, electric insulation, carbon paper, and ink. The outlook for the domestic asphalt industry is considered encouraging.

All hearings on the tariff bills covering war minerals have been postponed until September. This is the announcement of Chairman Fordney of the Ways and Means Committee to the American Mining Congress.

ARIZONA

WAGE INCREASES AT BISBEE AND DOUGLAS. SACRAMENTO HILL.

DOUGLAS.—The wage increase which became effective on July 23 in the Warren district and Douglas for employees of the Phelps Dodge Corporation, Copper Queen branch, and the Calumet & Arizona Mining Co., placed the Arizona copper miner on top of the heap so far as wages were concerned. Bisbee miners now draw $6.10 per day of 8 hours, an increase of one dollar from the previous scale, which became effective last December. Timbermen and skilled mechanics also received the one dollar increase. Muckers in the mines of the Warren district were increased 75c. to $5.60 per day. Mexican and other unskilled labor was increased 60c. per day. The smelters at Douglas had a similar increase, all men who had received $4.25 or more during the period previous to July 15 receiving 75c. per day increase, the men who had received less than that figure being given a 60c. increase. Skilled mechanics received one dollar increase. All employees receiving a monthly salary were raised 15%. In announcing the wage increase Grant H. Dowell, manager of the Copper Queen branch, made it plain that skill would be recognized by higher wages and the 50-cent difference between miners and muckers would be maintained, no matter to what level wages rose. He also called attention to the fact that the increase was based upon 24-cent copper, and that if the price rose further wages also would increase in conformity to the sliding scale agreement. The former sliding scale was still in effect, he stated, but on account of the increased cost of living the 24-cent base for the increase was adopted. He mentioned the Butte district, where miners received a wage increase to $5.75 per day and had agreed to maintain that figure for a year, and contrasted this with the Arizona plan whereby the employees of the companies in the Warren district, as well as those at Jerome, in the Globe-Miami district, and other large companies operating in the State, will profit by the anticipated rise in copper.

Calumet & Arizona is getting back upon something like a normal basis once more, as indicated by the June production of 4,142,000 lb. This was the best showing of any month since last October, was but 90,000 lb. less than the same month last year, and exceeded the May output by 294,000 lb. The kindred interests of the Calumet & Arizona reported a proportionate increase. New Cornelia reached 3,440,000 lb., or almost twice as much as had been made in the previous month, although it lacked 72,000 lb. of reaching the figure attained during the previous year in June.

In connection with the work of starting production from Sacramento hill, the publicity department of the Copper Queen branch announced the following facts: The ore in Sacramento hill is of a variety new to the Warren district, being disseminated and lying in the intrusion of the porphyry between the Pinal schist on the north and the limestone on the south. There are two orebodies, separated by a strip of barren ground which, although it contains some copper, is too low grade to be worked at a profit. The west orebody contains 7,660,000 tons of ore assaying 2.2% copper. The east orebody lies under the peak of the hill about 300 ft. beneath the summit, and extends downward about 400 ft. farther. It is estimated to contain 14,000,000 tons of ore and is somewhat better adapted to both underground and open-pit mining than the west body. The hill, which extends 300 ft. above the 5360-ft. level, will be taken down in four benches. The three lower ones will be 60 ft. high, but the top one, although averaging 60 ft., will attain a maximum height of 120 ft. The benches will be opened from the south working toward the north rim of the pit, thus breaking the ground away from the line of the El Paso & Southwestern railroad and the Naco road, the most traveled highway in the Warren district. They will be attacked separately, starting at the top bench, which will be kept well in advance of the lower ones to prevent undermining. In order to reach the top bench 2¾ miles of trackage must be laid, most of it on a 2½% grade with two switchbacks and a circuit of the hill to climb to the top. For a short time ground will be removed from all four benches and for a considerable time three benches will be working. Traffic during such times will be difficult. Trains from the upper level will join those from the lower ones and pass over the switch at the west end of the 5360-ft. level before distribution to the dumps. From 20 to 25 trains per hour, full or empty, must pass this point when operating at capacity. Before grading and laying tracks it was necessary to break down the ragged cliffs on the south side and establish a slope. Track grading on the north and east slopes of the hill had to be done with great care to avoid serious damage to property or loss of life as the hill is in the centre of a thickly populated section. Blasting had to be done most carefully and the entire work took twice as long as had been estimated. Safeguards were provided also for the men working on the hill. 'Bomb-proofs' in the form of conical steel houses were prepared

and the men compelled to retire to these when blasting. The ore in the hill differs greatly in copper content and several hundred thousand tons will be sent direct to the smelter. The ore is of a type favorable to concentration and is expected to give a high recovery.

CALIFORNIA

GRASS VALLEY AND SIERRA COUNTY.

GRASS VALLEY. The excavation for the new 20 stamps to be added to the Empire mill is well advanced and material is arriving each day. Milling has ceased at the Pennsylvania, which is a part of the Empire company, and upon completion of the latter mill the Pennsylvania mill will be dismantled. The mine is about to reach normal production following the serious setback that it received during the strike last June. The water is being rapidly lowered and work will be resumed on the lower levels as soon as they are drained.

The miners' strike came to an end officially on July 26, when the Mine Workers' Protective League voted to ratify the amended agreement by which the miners returned to work on June 30. Less than 15 voted against ratification out of a membership of 750. The important feature of the new agreement is the 10% bonus at the end of each 3 months of service and the privilege of temporarily quitting for a substantial reason at any time without loss of pay. No move has yet been made by the mine owners to carry out the free market and store features of the agreement, which the League members are expected to insist upon. Meetings are to be held hereafter weekly, at which times the matters of sick benefits, mutual insurance, and co-operation will be disposed of. The agreement runs until July 1, 1920, and may be suspended by either side upon notice. The paid membership of the League is about 750, with dues fixed at $1 per month. The damage to the mines and expenses of raising the accumulated water on account of calling out the pumpmen and engineers is estimated to have cost the operators between $25,000 and $50,000.

SIERRA COUNTY.—L. H. Holley, a merchant of Sierra City and James F. Hunt of Downieville, formerly District Attorney of Sierra county, located some soda springs at Parker Flat with the intention of marketing the waters and making a resort out of the place. While analyses were being made an investigation revealed a quartz vein 15 feet across from which the water flowed. Six feet of the vein assayed $6 and nine feet $4 and the locators are now in a quandary as to whether the mining of the vein and consequent destruction of the springs would be more profitable than bottling the water.

ONTARIO

COBALT, PORCUPINE, MATACHEWAN, GOWGANDA.

COBALT.—Every silver mine in the Cobalt district is closed owing to a strike of the miners who walked out on July 23 to the number of about 2000. The strike had been threatened for several weeks, but action was postponed from time to time in the hope that a settlement could be arrived at by the mediation of the Labor Department of the Federal government. Hon. Gideon D. Robertson, Minister of Labor, submitted several propositions to the mine managers with this end in view. He asked them to go to Ottawa for a conference with the executive of the union, and offered to appoint a Board of Conciliation, or a Royal Commission of Investigation. None of these plans was acceptable to the mine managers, who finally adhered to the position they have maintained throughout, that they could not recognize or deal with a union affiliated with the Western Federation of Miners. The miners were willing to accept the finding of a Commission and on the refusal of the employers to accept this suggestion the strike was called. The only serious point in dispute is the question of the recognition of the union, as, although other demands have been formulated by the miners, the difference between the terms asked for and those prevailing at the time of the strike is slight. The employers base their stand on the unsatisfactory experiences of the past in dealing with the Western Federation while the view entertained by the Minister of Labor is that during recent years the policy of the Western Federation has materially changed, and that the mine managers are not justified in judging the organization by the policy and leadership of ten years ago. The pumps of many of the mines have been taken out and the mines allowed to be flooded.

PORCUPINE.—The strikes at Cobalt and Kirkland Lake have relieved the labor situation at Porcupine, where there has lately been a considerable influx of labor. All danger of a strike appears to have been averted by the decision arrived at by a conference between mine managers and representatives of the miners. The Hollinger and the McIntyre companies have agreed to open stores with a view to reducing the price of goods at least 15%; the Hollinger, McIntyre, Dome, and Porcupine Crown will institute a free sick insurance benefit plan for their employees, and hospital accommodation will be provided. At a meeting of the mine-workers these plans were endorsed by a large majority vote.

The Hollinger will increase its plant by 40 stamps, a portion of the machinery being already on the ground. The present plant consists of 160 stamps and one ball-mill. This will increase the capacity to 3500 tons daily. The McIntyre is treating about 600 tons daily, the ore running $10 per ton. Its shaft is now down 1300 ft., making it the deepest mine in the district. A 5% dividend, payable August 30, has been declared. At the Davidson the new shaft has reached the 575-ft. level, its objective being 700 ft., where the diamond-drill indicates better results than those of the upper levels. Good progress in development has been made at the Clifton, where 25 ft. of driving has been done on the first level on a high-grade vein showing gold.

MATACHEWAN.—There is great activity in this gold area and many new properties are being developed. Important discoveries have been made on the Matachewan Rand, where an orebody, which is thought to be a continuation of that on the Matachewan (formerly the

Otisse , has been encountered. A contract for 15,000 ft. of diamond-drilling has been placed. The Matachewan has reached in the shaft at 160 ft. a vein indicated by diamond-drilling and will start lateral work at that level. The Miller Gentles syndicate is operating nine claims and has found ore of the same type as that of the Matachewan. Several promising veins have been uncovered on the sutherland claim.

GOWGANDA.—The Ontario government is building a macadamized road from Elk Lake to Gowganda, a distance of 27 miles, on which provision is made for an electric car line. This will stimulate development here, as one of the greatest drawbacks has been transportation troubles.

MAP SHOWING THE LOCATION OF THE PRINCIPAL MINING CENTRES IN ONTARIO

BRITISH COLUMBIA

GENERAL NEWS OF PORTLAND CANAL.

PORTLAND CANAL. The George copper mines in the Beaver River section of the Portland Canal Division have been bonded to the American Smelting & Refining Co. The George mines consist of ten claims: Mamie, Bessie, Gold Crown, Copper King, Copper Queen, Copper Lord, Castle Rock, Helena, Royal, and Waterfall, which are situated on the south side of Beaver river, six miles from the terminus of the Portland Canal Short Line. Three mineralized belts have been explored on the property; these are known, respectvely, as the Blue vein, the White vein, and the Green vein. The Blue vein is a 50-ft. belt comprising three veins aggregating 10 ft. of ore, which gives an average of $4 in gold and 3% copper. The White vein measures from 4 to 6 ft., and has been traced for 2000 ft. It has been explored by a number of open-cuts, and in some of these the vein shows some fairly rich copper ore. Thus, for example, in one cut 36 in. of ore on the foot-wall averages 14% copper, and the remaining 18 in. runs 8.8% with a small amount of gold and silver. But little work has been done on the Green vein, which parallels the White vein 50 ft. to its south. One sample across five feet of ore assayed 5% copper and $2 in gold and silver. The property is owned by W. B. and R. George. The consideration involved is $100,000.

The miners of the Portland Canal district will send to the Prince Rupert fair an exhibit of minerals, which,

after the close of the fair, will be turned into a permanent display in that city under the management of the Free Miners League. A strike of rich silver ore, carrying native metal and argentite, has been made at the Big Missouri, which is under option to Sir Donald Mann. The Hon. W. Sloan, Minister of Mines, who has recently returned from a visit to the mine, has announced that the provincial government will continue the road up to the Big Missouri, in order to facilitate ore shipments this winter. A survey has been completed recently for a railway from Steward, at the head of the Portland canal, up the Salmon River valley, and when the road is completed it will be a great boon to the many mines in this district. The railroad from Alice arm to the Dolly Varden mine has been finished. The loading-chutes at the Tallor Mining Co.'s wharf are finished, and it is expected that ore shipments will start at once. The Blue Bell mine, in the Ainsworth section, is being unwatered by a new 1000-gallon pump. A heavy flow of water caused a cessation of underground operations last year, but some 5000 tons of oxidized lead and zinc ore was shipped from surface operations.

MEXICO

MINE SUPERINTENDENT MURDERED.—NEWS OF THE LOUISE MINE.

ZACATECAS.—Theodore Patterson, a British subject and superintendent of the important group of mines owned and operated by the Mazapil Copper Co. at Aranzazú, State of Zacatecas, was murdered under circumstances of peculiar brutality by a mob of miners in the employ of the company. The crime, which was committed with cold-blooded ferocity, was undoubtedly premeditated and executed in accordance with pre-arranged plans. The facts are as follows: At about 8 o'clock on the morning of July 18, Patterson was on the mine *patio* attending to his usual duties; without any warning, he was set upon by a mob of about 200 men, who had as it seems been waiting for him to appear. Realizing the peril of his position, Patterson attempted for a time to stand them off, but seeing that they were entirely out of hand and that all arguments were useless he then tried to escape from them and ran for his life. He was then fired upon by the crowd, who were in full pursuit, and was struck by a rifle-bullet, which passed through his body. Although mortally wounded, Patterson managed to crawl into a hut that happened to be occupied by some women, who, instead of extending any assistance to the now dying man, immediately fled, abandoning him to the mercies of the rabble. Seeing Patterson helpless and in his death agony, they showed their respect for the elementary laws of humanity by throwing several dynamite bombs at him, and then, satisfied with their work and having no fear of consequences where a mere foreigner was concerned, they fell upon the body and literally hacked it to pieces with their knives. All this occurred in full view of several hundred people, including members of the police, none of whom attempted to interfere in any way or to render the victim the slightest assistance.

The above is only another instance of the chaotic conditions prevailing in Mexico. This is principally due to the supine and often frankly hostile attitude assumed toward foreigners by the powers that be, and also in great measure to the unaccountable indifference manifested by foreign governments where the welfare of their nationals resident in Mexico is concerned. Hatred and contempt of, and outrages on, foreigners are of daily occurrence, the Mexicans being fully persuaded by this time that no account will be required of them, and that no effective steps will be taken to put an end to conditions which are a disgrace to this continent in particular and to civilization in general. It is noteworthy and extremely significant that not one word concerning the above outrage appeared in the local press, but this is the rule and not the exception where attacks on foreigners are concerned. On the other hand, a grotesque distortion of the facts appeared in one of the Mexico City dailies.

SONORA.—The Louise Mining company, at Buenavista, Sonora, now employs about 100 men and has developed a considerable body of lead-silver ore. The main shaft is down 300 ft. and driving operations on the 300-ft. level are under way. A 50-ton flotation mill has just been completed and will be put in operation about September 1. Several years' supply of ore has been blocked out underground. Headquarters of the company are at Charleston, West Virginia. H. J. Wendler of Los Angeles is general manager.

QUEBEC

THE CHROME SITUATION.

An unexpected and sudden demand for chrome has come to the Quebec district, an important source of chrome during the War and a producer in small amounts for several years before. After the Armistice the demand ceased and the outlook for chrome mining was bad indeed. An effort was made to secure connections in Great Britain, but the uncertainty as to freight-rates deferred satisfactory contracts. Recently American buyers have been in evidence and contracts have been closed at good prices. One contract for 2000 tons is reported at 70c. per unit for 30% chrome oxide minimum and an offer of 85c. is reported. The buyers are the big steel companies of the United States. It is rumored that the United States Steel Corporation has taken an option on the holdings of the Black Lake Chrome & Asbestos Co. for $1,000,000. These include more than 800 acres on Caribou lake, east of Black Lake station on the Quebec Central railroad. Recent developments on the adjoining property of the Mutual Chemical Co. of New York have shown an orebody with the best grade of chrome ore yet found at 200 ft. in depth. Another new chrome development is under way on the Ross lot about a mile west of Black Lake station. The Quebec chrome runs from 30% up to 50% for shipping grades. The minimum shipping grade is 30%. The lower grade ore is milled.

THE MINING SUMMARY

ALASKA

Valdez. The stampede to the newly discovered platinum fields, eight miles out of town, continues unabated. Several new discoveries have been made in other localities some of which are reported to be richer than those first reported. Men have been dropping out of town by fives and tens, staking promising ground, and prospecting other localities for the precious metals. Assays received from the first shipment, from five pans of dirt, from the supposed platinum deposits, brought $8 in gold and $247 in platinum.

ARIZONA

Mayer.—The new wagon-road from the mine of the Franco-American Copper Co. is nearing completion. The re-timbering of the old shaft has been finished and sinking below the 300-ft. level is to be resumed. Preparations are being made to ship 1500 tons of 20% copper ore now on the dump.

Miami.—The 35-ton copper-leaching plant of the Inspiration Copper Co. has been completed and is operating. This plant is an experimental plant intended to work out a commercial method of treatment for the large tonnage available of carbonate and silica ores of copper.

Superior.—The 1800-ft. tunnel of the Magma Copper Co., which is now in 75 ft., is progressing at the rate of 5 ft. per day. This tunnel, which is to connect with the mine workings at the 500-ft. level, is 12 by 12 ft. It is to be concreted throughout and when completed will be the main haulage tunnel for ore and underground supplies.

Tucson.—The regular bi-monthly meeting of the Arizona Chapter of the American Mining Congress was held in Tucson last week, at which it was said the question of increase in wages was discussed in view of the increase in the price of copper. The meeting was an informal one, and was attended by all the large operators of the State.

Yavapai County.—The Arizona State Tax Commission has assessed the value of all mining property being operated in the State of Arizona for the year 1918 at $416,080,482, which compares with the assessed valuation for 1919 of $417,704,615, showing an increase for the year 1919 of $1,624,133. The County Assessors of Arizona have placed upon other operative property of the mining companies $57,593,276 as compared with $51,861,191 in 1918. On non-productive property owned by mining companies, such as town-sites, buildings, stores, supply-houses, and other classes of property, owned by the mines but not actually productive, the assessment for the year is $7,916,633. The grand total of the assessments of the producing mines, reached the enormous total of $483,184,526, or more than one-half the assessed valuation of all the property in the State. Of this valuation the United Verde Copper Co., at Jerome, in the Verde district of Yavapai county, comes third with a valuation of $50,273,788. By counties, the largest valuation of mining property goes to Gila; second, to Cochise; and third, to Yavapai.

CALIFORNIA

Downieville.—Development of the City of Six property is progressing vigorously under the management of A. E. Hodgkinson, representing Los Angeles capital. Good ore has been opened in a new section of the ground, and the owners have arranged for a comprehensive campaign of development until winter sets in.

Dutch Flat.—The Bear Barite Co., under the management of B. C. Van Emon, on the Lowell Hill Ridge, is working several men and preparing for development on an extensive scale. Samples of the ore sent to San Francisco have assayed well. William Patrick of Dutch Flat has been given the contract for hauling the ore to the Southern Pacific railroad, a distance of seven miles.

Graniteville.—W. L. Baker has a force of men employed at his quartz property on the northern rim of this place. A drift is being driven from the bottom of the 100-ft. shaft to intersect the vein, which is expected to be reached soon. Baker has a number of railroad employees associated with him in exploring the mine. There is a five-stamp mill on the property, together with a new hoisting and pumping plant.

Knob.—The Victor Power & Mining Co. has taken over the bond given by E. P. Conner & Son on their Bull Moose mine, which closely adjoins the claims of the Victor. Two Gibson mills are kept running on ore from the Bull Moose and the Victor mines.

Oroville.—Preliminary work has started at the Indian Springs gravel mine, in the Magalia district. Los Angeles capitalists, represented by J. Woodruff, have acquired control of the old producer, which has yielded approximately $4,000,000 in gold. The adjoining Hupp property has been taken under lease and option, and it is planned to operate both mines through the main working tunnel of the Indian Springs, which is 4000 ft. long.

Placerville.—The Ohio deep gravel mine, which has been worked in a crude manner intermittently for the past sixty years, is to be operated by modern methods. B. Soderhjelm has taken over the property under bond, and will install modern machinery operated by electric power. Heretofore the gravel from the mine was reduced by washing in sluice-boxes, and only part of the free gold was recovered. Much of the gold was washed away and lost in the tailing.

The mine covers an area of 60 acres in the White Rock district, 2½ miles north-east of Placerville.

Sierra City.—There is considerable of a revival in mining in this district, and indications for the future are promising. A. D. Walker of Portland, Oregon, has been visiting the One Thousand One gravel mine, and is well pleased with the conditions. A drift is being driven to tap the gravel channel, under the direction of H. G. Coffin, the superintendent.

Sierra County.—John Costa is re-timbering tunnel No. 4 on the White Bear gravel claim with a small crew where he expects gravel may be found in raising. It was at first thought that a new tunnel would be necessary to be run at a much lower point than present workings on account of a break in the channel and now tunnel No. 4 will be tried out before new work is attempted.

Yreka.—The Roxbury Mining Co. of Scott Bar, composed of Boston capital, has made application to the State Water Commission for a water right of 60 cu. ft. per second from

Canyon creek and 65 ft. per second from Kelsey creek for mining purposes. They now are getting water from the Tom Martin and Muck-a-Muck creeks, near Scott Bar, but these creeks furnish only enough water to run a two and three-inch giant for about four months each year.

COLORADO

Georgetown.—Incorporators for the Georgetown district of the Sixth State Exploration company, the Georgetown branch of the State Mines Development Association, include the following: J. H. Robeson, H. S. Bushnell, H. W. Kirby, George B. McFadden, J. A. Noone, G. L. Cole, John Tomay, J. J. White, J. B. Foley, and R. G. Hoffman. Meetings have been planned for Silver Plume, Empire, and Lawson to bring the local association to the highest possible membership. The committee last week was successful in securing many new members, every one who felt able readily subscribing for the shares.

Kokomo.—The Queen of the West group of patented claims, located on Jacque mountain in the Ten Mile mining district of Summit county, near Kokomo, has recently been examined for Chicago and New York investors holding an option on the property, and the purchase of the group is now understood to be under favorable consideration.

Montezuma.—Articles of incorporation of the Montezuma Consolidated Silver Mines Co. have been filed for record with the county clerk and recorder. The directors for the fiscal year are Joseph Giediartz, Fred C. Ewing, Clarence A. Brandenburg, John F. Haggerty, W. F. Galbraith, V. C. Miller, and M. Winter. The main office of the company will be maintained at Montezuma, Summit county, Colorado.

Rico.—The Silver Gulch Mining & Milling Co. has a force of men at work excavating for foundations for the milling plant to be constructed to treat ores from the Rosebud mine and dump. A saw-mill to cut lumber for mill construction will be removed from Dunton and erected at the mine. The company is mining high-grade silver ore at the Rosebud and a small consignment of the high grade was loaded out during the past week.——The Marmatite Mining company resumed work last week on the Pro Patria, driving on the Enterprise vein and carrying a raise to the contact where a rich ore-shoot is expected. The company has also a lease on the tram and mill, and both will shortly be in operation.

IDAHO

Coeur d'Alene.—Operations are expected to be in full blast at the Consolidated Interstate-Callahan mine soon. Miners are being put to work as fast as they apply for employment, and word has been sent out to former employees to report as soon as possible and that their old positions will be held for them. The property has been closed for several months owing to the adverse metal market and the shortage of miners. The Consolidated Interstate-Callahan Mining Co. in the last four years has become one of the largest producers of zinc in this country. In this period it has shipped 215,680,459 lb. of zinc, 52,673,430 lb. of lead, and 949,980 oz. of silver, with a combined value of $11,461,364.——The first demonstration of union miners in the Coeur d'Alene in 20 years took place at Wallace on July 27, when 800 mine employees from Wardner-Kellogg, Mullan, Burke, Mace, Gem, and Nine-Mile district paraded the streets and gathered in the city park, where they were addressed by E. W. Muir, State organizer for the American Federation of Labor, and J. O'Neill, said to have formerly published a radical labor paper in Denver, Colorado.——With the completion of the Nabob mill on Pine creek, and a report that the management expects to find the lost Stewart vein in the old Stewart workings, considerable interest is manifest in Kellogg in the operations of the Stewart company, which controls the Nabob. One of the directors who has just returned to New York after an inspection of the properties, reports the 150-ton mill at the Nabob ready for its first performance, and that it probably will turn out its first tonnage before August 1. This director estimates a profit of $1000 per day from the lead and silver contents of the Denver-Nabob ore.

MONTANA

Anaconda.—The Cottrell process for fume precipitation at the Washoe smelter has been in operation several days and is proving effective. It is the opinion of the company chemists that no injurious matter is now escaping from the big stack. The dust recovered is of high value.

Butte.—All of the local unions with the exception of the Metal Trades and allied unions have voted to accept the wage-scale recently presented by the companies, and all men employed at this time and belonging to the unions which accepted the wage-scale will receive the increased wages. The Metal Trades and allied unions will not receive the increase at this time. The new wage-scale is as follows: Boiler cleaners, $6; boiler-cleaner helpers, $5.50; cable repairers, $6; cable repairer boss, $6.50; carpenters, $6.50; carpenter boss, $7; sawyers, $6; sawyer helpers, $5.50; compressor men, $6.50; diamond-drill runners, $6.25; diamond-drill runners' helpers, $5.75; engineers, first motion, $7; engineers, geared, $6.50; firemen, $6; ash wheelers, $5.50; laborers, $5; laborer boss, $5.50; change-house men, $4.50; masons, $8; mason helpers, $5.50; miners, all underground men engaged in mining, $5.75; miners, in shafts, station cutting, and winzes, $6.25; drivers, locomotive surface, $5.50; oilers, regular, $5; oilers, second-class license, $5.50; pumpmen, $6.50; pipemen, underground, $6.25; painters, $6.50; painter boss, $7; station tenders, $6.25; teamsters and stablemen, $5.25; tool men, $5.75; watchmen, $4.50; structural iron workers, $6.50; structural iron worker, boss, $7; shift-bosses, $7.25; timekeepers, per month, $165; foreman's clerks, per month, $165; electrician helpers (not apprentice), $5.50.——Options to purchase the Mary Louise and the Otisco claims, situated just south of the Davis-Daly Copper Co.'s holdings, have been secured by the Hayden-Stone interests. In addition to the Mary Louise and the Otisco options on the Syndicate fraction, amounting to four acres, the Railroad lode of 8½ acres has been secured. Negotiations are also in progress to secure an option or to control the stock of the Consolidated Central Copper Co. and the Alliance Copper Co. All told the Hayden-Stone interests have succeeded in securing options or controlling interests on nearly 200 acres in this district. Work has already been started.

NEVADA

Austin.—Ore has been opened in the main working tunnel of the Austin Nevada Consolidated mine. The product runs high in silver with the vein over 20 ft. wide. H. G. Richardson, the president, states that 75 distinct orebodies have been proved to extend into the property, including extensions of many of the great orebodies that produced upward of $50,000,000 in the adjoining Manhattan group over thirty years ago.——High-grade ore is under development in the property recently acquired by Emmet D. Boyle and his associates. The mine adjoins the Austin Nevada Consolidated on the north, and the sinking of a working shaft is making good progress. The discovery opens to mining a new part of the famous Reese River field.

Divide.—The shaft of the Victory Divide has reached a depth of 200 ft. The last 70 ft. was sunk in two weeks with two shifts and the management claims a record for the district for Bob Wilson, superintendent. A sump will now be made, a station cut, and cross-cutting started toward the junction of the main Tonopah Divide vein and the east-dipping north vein.——Reports from the Rosetta Divide are to the effect that there is a splendid showing on that

property. The main shaft now has a depth of approximately 300 ft., and for the last 20 ft. a favorable body of ore has been followed on the foot-wall side of the workings, assays averaging $22 per ton in gold and silver being reported. As soon as a station has been cut driving will be started to prove the vein. The company has been plodding along for a long period, having been one of the first corporations to enter the district during the early part of this year, and the fact that the property gives promise of soon becoming a shipper will prove good news to all interested in the district.

Ely.—All mechanical departments and operating employees of the Consolidated Copper Co. and Neveda Northern Railway Co., with few exceptions, are on strike, following the companies refusal of a demand by the men for restoration of the pre-armistice wage scale. This would mean an increase of $1 per day, while the companies posted a wage increase of 75c. per day. The situation, although serious, is not hopeless and there has been no attempt on the part of interested parties toward aggressive tactics. The trainmen have submitted a revised scale of wages and are not now on strike. The main line passenger train between Ely and Cobre is moving and the camp is quiet and orderly.

Eureka.—Officials of the Eureka-Croesus Mining company report that at a depth of about 900 ft. the company has opened a body of high-grade ore 27 by 22 ft. Samples of the ore have assayed $150 per ton, and the entire ore mass runs from $65 to $80. Several 50-ton shipments to the smelter of the mine run of this ore brought an average of $62 per ton. The orebody is rapidly increasing in size as depth is gained.

Kimberly.—Kimberly has been selected as the site for the projected smelting plant of the Consolidated Coppermines company. The plant will have a concentrating department capable of treating 2000 tons of porphyritic ore and 150 tons of sulphide ore daily, and reverberatory furnaces capable of treating all concentrates and 150 tons of oxidized ore per day. The crushing plant is to have a capacity of 3000 tons per eight hours. To operate the various plants and mine equipment an electric power unit capable of generating 3000 kilowatts is to be installed.

Tule Canyon.—A. L. Borcherding, manager for the association of Goldfield men who have taken over the Benton-Radford-Smith placer claims at the upper end of Tule canyon, states that he has opened $6 gravel seven feet from bedrock in the inclined shaft that was started from the side of the canyon a short time ago. The 'pay dirt' was found at a vertical depth of 20 ft.——The cross-cut of the Goldfield-Tule Canyon Placer Mining Co. has been driven 75 ft. from the shaft.

BRITISH COLUMBIA

Trail.—The following statement gives the ore received at the Trail smelter during the week ending July 21:

Mine and location	Gross tons
Center Star, Rossland	1,120
Cork-Provine, Zwicky	36
Emma, Coltern	167
Iron Mask, Kamloops	44
Josie, Rossland	78
Mandy, The Pas	284
Molly Gibson, Kitte Landing	89
North Star, Kimberley	289
North Star, Greenwood	2
Rambler, Three Forks	66
Silver Bell, Adamant	35
San Poil, Republic, Washington	183
Sullivan (zinc), Kimberley	3,942
Sullivan (lead), Kimberley	284
Total	6,619

PERSONAL

Note.—The Editor will be pleased to receive items of personal interest from members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

Albert Burch is at Butte.

Richard A. Parker is in New York.

Charles W. Merrill is at Lake Tahoe.

W. de L. Benedict is here from New York.

E. Cushing Moore has opened an office at Spokane.

R. S. Webber, of Haze, Nevada, is in San Francisco.

Forbes Rickard has returned from Chicago to Denver.

Jackson A. Pearce has changed his residence from Berkeley to Los Angeles.

L. D. Ricketts is in Montana, on his way to the National Park, where he will do a little fishing.

William A. Simkins, Lieutenant in the A. E. F., has returned from France to San Francisco.

Myron A. Folsom, who has been engaged in oil mining in Texas, is in San Francisco this week.

James Underhill has been appointed Associate Professor of Mining in the Colorado School of Mines.

S. J. Truscott succeeds **William Frecheville** as Professor of Mining in the Royal School of Mines, London.

S. F. Shaw has returned to Charcas from an inspection of the Bonanza property at Mazapil, in Zacatecas, Mexico.

John T. Reid has returned to Lovelock, Nevada, from north-eastern Oregon; he will leave for New York in October.

George W. Evans, having resigned as District Mining Engineer for the U. S. Bureau of Mines, has resumed consulting practice as coal engineer at Seattle.

M. Q. Moffitt, formerly mill-superintendent for the Mexican Candelaria Mines, is now in the sales department of the Taylor Wharton Iron & Steel Co., Chicago.

R. R. Shatter, after two years as general superintendent of the shipyard of the Traylor Shipbuilding Corporation, has returned to the Traylor Engineering & Manufacturing Co. as district manager of its New York office.

Engineering and mining men throughout the country will be interested in the reorganization plans of the Bureau of Mines just announced. Dr. F. G. Cottrell, chief metallurgist of the Bureau, who became a national figure through the invention of the Cottrell process for utilizing smelter fume by extraction of arsenic and various other commercial chemicals from the escaping noxious gases, has been named Assistant Director in charge of all investigative and scientific work. F. J. Bailey, for years Chief Clerk of the Bureau, becomes assistant to Director Manning in charge of executive work. J. E. Spurr, who at the outbreak of war became Director of War Minerals Investigations, and after passage of the War Minerals Relief Bill was appointed chief of investigative work in connection with relief claims, has resigned to become editor of the 'Engineering & Mining Journal' of New York. No successor to Mr. Spurr has been appointed. H. E. Meyer, Chief Clerk of the War Minerals Relief Commission, has been appointed Chief Clerk of the Bureau of Mines, and C. P. Robertson succeeds Mr. Meyer.

F. H. Evans, manager of the Sulphide Corporation's smelter at Cockle Creek, New South Wales, died of pneumonia, following influenza, on June 22.

Book Reviews

Mineral Deposits. Second edition, revised, enlarged, and entirely re-set. By Waldemar Lindgren. Pp. 957 + xviii. McGraw-Hill Book Co., Inc., New York. For sale by 'Mining and Scientific Press'. Price, $5.

This second edition of Professor Lindgren's well-known book is a worthy attempt to bring his readers up to date on some of the new facts and theories that have accumulated so rapidly during the last six years on the subject of minerals and mineral deposits. Among the most important of these are the investigations on magmatic and contact-metamorphic ore deposits; problems of oxidation and supergene sulphides; and the application of metallographic methods to ores, by which their study has been facilitated and valuable light thrown on the complexity of metallic replacements. All the chapters of the book have been revised, and those on deposition of minerals, contact-metamorphism, oxidation, and sulphide enrichment have been largely rewritten. A discussion of metallogenetic epochs has been added, as well as an index by elements, which will enable the student to co-ordinate rapidly the deposits of any given metal. The genetic arrangement of the first edition has been followed. For the benefit of those unfamiliar with the first edition, it may be stated that the general plan has been to select a few suitable examples to illustrate each genetic group, the examples being chosen regardless of their geographic distribution. As can be seen from the appended chapter-headings the book covers the field thoroughly. In the introduction are given, where they are convenient for reference, certain elementary definitions and facts, together with a brief statement of the discoveries of early investigators. Having thus started square with his reader, the author takes up the various laws that influence the formation of minerals, the flow and composition of underground waters in different rocks and soils, and their effects on metamorphism and replacement. We are glad to see that structural geology is treated adequately and clearly, aided by numerous excellent diagrams. Many books on ore-genesis neglect this branch of geology, assuming that the reader will be sufficiently well acquainted with it; and yet it is precisely details of this kind that interest the mining engineer and enable him to grasp the otherwise academic conclusions of the professor and apply them to the solution of his mining problems. For similar reasons we would have liked a little more space devoted to the persistence of ore in depth. On page 147 the author starts the study of mineral deposits proper, and carries the reader through a thorough exposition of the principal types. The bibliography is exceptionally complete, but instead of being segregated at the end of the volume or after each chapter, the references are in the form of foot-notes scattered through the book where most relevant, thus facilitating reference. We commend this book to students, geologists, and mining engineers; in fact, to all who are interested in a skilful and thorough presentation of the subject. The chapter-headings follow: I, Introduction; II, The Formation of Minerals; III, The Flow of Underground Water; IV, The Composition of Underground Waters; V, The Chemical Work of Underground Water; VI, The Origin of Underground Water and Its Dissolved Substances; VII, The Spring Deposits at the Surface; VIII, Relations of Mineral Deposits to Mineral Springs; IX, Folding and Faulting; X, Openings in Rocks; XI, The Form and Structure of Mineral Deposits; XII, The Texture of Mineral Deposits; XIII, Ore-Shoots; XIV, The Classification of Mineral Deposits; XV, Deposits Formed by Mechanical Processes of Transportation and Concentration; Detrital Deposits; XVI, Deposits Produced by Chemical Processes of Concentration in Bodies of Surface Water by Reactions Between Solutions; XVII, Deposits Formed by Evaporation of Bodies of Surface Waters; XVIII, Mineral Deposits Resulting From Processes of Rock Decay and Weathering; XIX, The Hematite Deposits of the Lake Superior Region; XX, Deposits Formed by Concentration of Substances, Contained in the Surrounding Rocks, by Means of Circulating Waters; XXI, Deposits Resulting from Regional Metamorphism; XXII, Deposits of Native Copper with Zeolites in Basic Lavas; XXIII, Lead and Zinc Deposits in Sedimentary Rocks; Origin Independent of Igneous Activity; XXIV, Metalliferous Deposits Formed Near the Surface by Ascending Thermal Waters and in Genetic Connection with Igneous Rocks; XXV, Metalliferous Deposits Formed at Intermediate Depths by Ascending Thermal Waters and in Genetic Connection with Intrusive Rocks; XXVI, Veins and Replacement Deposits Formed at High Temperature and Pressure and in Genetic Connection with Intrusive Rocks; XXVII, Deposits Formed by Processes of Igneous Metamorphism; XXVIII, Mineral Deposits of the Pegmatite Dikes; XXIX, Mineral Deposits Formed by Concentration in Molten Magmas; XXX, Metamorphosed Deposits; XXXI, Oxidation of Metallic Ores; XXXII, Metallogenetic Epochs. It remains to add that the book is written with all the lucidity and attractiveness of style that we are accustomed to expect from Professor Lindgren.

Metal Worker's Handy Book of Receipts and Processes. By William T. Brannt. Pp. 550. Ill., index. Henry Carey Baird & Co., Inc., New York. For sale by 'Mining and Scientific Press'. Price, $3.

The wide scope of this remarkable collection of data can best be judged from the chapter-headings, which are as follows: Chemical Relations of the Metals; Metallic Preparations and Chemicals Used in the Metal Industry; Determination of the Constituents of Metallic Alloys; Alloys and Amalgams; Annealing, Hardening, and Tempering; Bronzing and Coloring; Casting and Founding; Cements; Cleansing, Grinding, Pickling, and Polishing; Decorating, Enameling, Etching, and Engraving; Electro-Plating; Brassing; Coppering; Galvanizing, Gilding, Etc.; Fluxes and Lutes; Lacquers, Paints, and Varnishes; Soldering and Solders; Welding and Welding Compounds; Wire; Flame Welding and Cutting; Thermit Welding; Electric Welding; Galvanizing and Sherardizing; Die Castings. The chapter on Alloys and Amalgams, for instance, contains receipts for more than one hundred distinct alloys, and the chapters discussing processes are equally exhaustive. As is important in a book of this kind, the index is ample, comprising more than thirty pages, and is well arranged. With such a wide field and such a comparatively small book, discussion of theory is wisely omitted as well as any other matter of text-book rather than reference-book character. Furthermore, there is no one with such wide interests as to find all of the book of direct value to him. Nevertheless, the book will be worth while to almost anyone engaged in practical work in one or more of the fields of activity indicated by the chapter-headings.

Abrasives and Abrasive Wheels. By Fred B. Jacobs. Pp. 321, ill., index. Norman W. Henley Publishing Co., New York. For sale by 'Mining and Scientific Press'. Price, $3.

The growing importance of grinding and grinding-wheels alone warrants the publication of an up-to-date book dealing with the subject of abrasives and their uses. The present volume opens with a discussion of natural and artificial abrasives, and then considers the manufacture, testing, and operation of grinding-wheels and grindstones, including a discussion of dust-collecting systems and safeguards. Chapters are also devoted to surface grinding, cylindrical grinding, internal grinding, and special grinding operations, as well as cutter sharpening and saw sharpening. The book is well illustrated.

THE METAL MARKET

METAL PRICES

San Francisco, August 5

Aluminum dust, cents per pound	50—60
Antimony, cents per pound	9.50
Copper, electrolytic, cents per pound	24.00
Lead, pig, cents per pound	6.25—7.50
Platinum, pure, per ounce	$105
Platinum, 10% iridium, per ounce	$121
Quicksilver, per flask of 75 lb	$105
Spelter, cents per pound	9.50
Zinc dust, cents per pound	11.00—13.50

EASTERN METAL MARKET

(By wire from New York)

Aug. 5.—Copper is quiet and easier. Lead is slightly weaker under outside offerings. Zinc advances abruptly and is strong.

SILVER

Below are given official or ticker quotations, in cents per ounce of silver 999 fine. From April 23, 1918, the United States government paid $1 per ounce for all silver purchased by it, fixing a maximum of $1.01½ on August 15, 1918, and will continue to pay $1 until the quantity specified under the Act is purchased, probably extending over several years. On May 5, 1919, all restrictions on the metal were removed, resulting in fluctuations. During the restricted period, the British government fixed the maximum price five times, the last being on March 25, 1919, on account of the low rate of sterling exchange, but removed all restrictions on May 10. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the normal rate of exchange.

Date	New York cents	London pence	Average week ending	Cents	Pence
July 30	107.50	54.06	June 24	111.52	54.40
" 31	107.00	55.43	July 1	108.83	53.48
Aug. 1	107.62	55.75	" 8	107.52	53.47
" 2	108.00	56.50	" 15	106.35	53.38
" 3 Sunday			" 22	104.85	54.25
" 4	109.00	Holiday	" 29	106.54	54.99
" 5	109.37	56.12	Aug. 5	108.08	55.17

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	75.14	88.72	101.12	July	78.92	99.62	106.36
Feb.	77.54	85.79	101.12	Aug.	85.40	100.31	....
Mch.	74.13	88.11	101.12	Sept.	100.73	101.12	....
Apr.	72.51	95.35	101.12	Oct.	87.38	101.12	....
May	74.61	99.50	107.23	Nov.	85.97	101.12	....
June	76.44	99.50	110.50	Dec.	85.97	101.12	....

In stating in advices emanating from Washington that "there is considerable quiet interest in Congressional and business circles as to the future price of silver," the "Wall Street Journal" of July 22 had the following to say:

Western interests are favoring additional legislation which will raise the limit below which the price of silver may not go. Director of the Mint Baker has just returned from an extended visit through the West. He finds this sentiment growing. As a rule it does not find favor in Administration circles, but Director Baker himself is non-committal on the subject. On the other hand, Senator Pittman (Nevada), who has taken an active interest in all silver legislation since he came to the Senate, is very frank in his position. "I believe in letting well enough alone," said Senator Pittman, when asked about prospective silver legislation. "The situation with regard to silver is very satisfactory since the passage of the Pittman Act, fixing the price at not less than $1 an ounce. Of course, there is a great demand, and some of my friends in the West have been enthusiastically talking about the possibility of $1.50 an ounce. I have advised them, however, that I did not think it would go beyond $1.15. England is not buying silver above $1.10, and any higher price than that would probably have a disturbing influence on the rupee. It should be remembered that prior to the War 30,000,000 oz. of silver went into the arts every year. The limitation on such use of the metal created a shortage in the arts of an easy 75,000,000 oz., and it is my opinion that the increasing demand for silver in the market now is due to a desire to meet that shortage."

COPPER

Prices of electrolytic in New York, in cents per pound.

Date		Average week ending	
July 30	23.25	June 24	17.89
" 31	23.00	July 1	18.37
Aug. 1	22.75	" 8	18.53
" 2	22.75	" 15	20.29
" 3 Sunday		" 22	21.50
" 4	22.75	" 29	23.50
" 5	22.75	Aug. 5	22.87

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	29.53	23.50	20.43	July	29.67	26.00	20.82
Feb.	34.57	23.50	17.34	Aug.	27.42	26.00	....
Mch.	36.00	23.50	15.05	Sept.	25.11	26.00	....
Apr.	33.16	23.50	15.23	Oct.	23.50	26.00	....
May	31.69	23.50	15.91	Nov.	23.50	26.00	....
June	32.57	23.50	17.53	Dec.	23.50	26.00	....

LEAD

Lead is quoted in cents per pound, New York delivery.

Date		Average week ending	
July 30	6.00	June 24	5.36
" 31	5.85	July 1	5.40
Aug. 1	5.85	" 8	5.40
" 2	5.85	" 15	5.42
" 3 Sunday		" 22	5.62
" 4	5.85	" 29	5.91
" 5	5.85	Aug. 5	5.87

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	7.64	6.85	5.60	July	10.93	8.03	5.53
Feb.	9.10	7.07	5.13	Aug.	10.75	8.05	....
Mch.	10.07	7.26	5.24	Sept.	9.07	8.05	....
Apr.	9.38	6.99	5.05	Oct.	6.97	8.05	....
May	10.29	6.88	5.04	Nov.	6.38	8.05	....
June	11.74	7.59	5.32	Dec.	6.49	8.00	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound:

Date		Average week ending	
July 30	7.70	June 24	7.02
" 31	7.55	July 1	7.36
Aug. 1	7.45	" 8	7.45
" 2	7.50	" 15	7.74
" 3 Sunday		" 22	8.17
" 4	7.72	" 29	8.32
" 5	7.95	Aug. 5	7.61

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	9.75	7.78	7.44	July	8.98	8.72	7.78
Feb.	10.45	7.97	6.71	Aug.	8.58	8.87	....
Mch.	10.78	7.67	6.53	Sept.	8.33	9.58	....
Apr.	10.20	7.04	6.49	Oct.	8.32	9.11	....
May	9.41	7.92	6.43	Nov.	7.76	8.75	....
June	9.63	7.92	6.91	Dec.	7.84	8.49	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. Prices, in dollars per flask of 75 pounds:

Date			
July 8	100.00	July 22	100.00
" 15	100.00	" 29	105.00
		Aug. 5	105.00

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	81.00	128.06	103.75	July	102.00	120.00	100.00
Feb.	126.25	118.00	90.00	Aug.	115.00	120.00	....
Mch.	113.75	112.00	72.80	Sept.	112.00	120.00	....
Apr.	114.50	115.00	73.12	Oct.	102.00	120.00	....
May	104.00	110.00	84.80	Nov.	102.50	120.00	....
June	85.50	112.00	94.40	Dec.	117.42	115.00	....

TIN

Prices in New York, in cents per pound:

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	44.10	85.13	71.50	July	62.60	93.00	....
Feb.	51.47	85.00	72.44	Aug.	62.53	91.33	....
Mch.	54.27	85.00	72.50	Sept.	61.54	80.40	....
Apr.	55.63	88.53	72.50	Oct.	62.24	78.82	....
May	63.21	100.01	72.50	Nov.	74.18	73.67	....
June	61.93	91.00	71.83	Dec.	85.00	71.52	....

FOREIGN EXCHANGE

Sterling has been steadier without much change for the week; francs are somewhat better; lire still decline. Banking attention still continues focused on our trade and financial relations with Europe, of which one of the vital factors is foreign exchange. With exports for June totalling $918,000,000 it is evident that the problem is of proportions to warrant concerted action. Practically all European nations have been sounding the American money market as to what credits they can obtain. Bankers are accommodating them as rapidly as possible, the total for a recent week being estimated at $300,000,000. The latest reports concern a $12,000,000 bond issue for the city of Copenhagen being negotiated, and rumor also has it that the Omsk or Kolchak government wants to borrow at least $25,000,000 here. Although Germany unquestionably will also want to borrow here, no tangible evidence is forthcoming to substantiate the cabled story of a $100,000,000 loan practically placed. Apparently no single American bank will care to stand sole sponsor for such a loan. The one definite German item is the fact that the $18,000,000 in gold recently received from England by way of Canada was originally paid Belgium by Germany and in turn sent across the Channel.

Quotations on August 5 are as follows:

Sterling:	Cable	4.37½
	Demand	4.36½
Francs:	Cable	7.15
	Demand	7.00
Lire:	Demand	8.75

Eastern Metal Market

New York, July 30.

All the markets are less active but prices are in most cases firm.

Lessened activity has characterized the copper market the past week, but prices are unchanged and firm.

The tin market has been rather quiet but a small business has been done. The tone is strong.

Lead has enjoyed another advance although the market is quiet but firm.

The zinc market has experienced a reaction, demand has subsided, and prices are lower.

Antimony is quiet but strong.

IRON AND STEEL

Operations at steel plants and blast-furnaces are increasing, especially in the Pittsburgh district, but of its 59 blast-furnaces the Carnegie Steel Co. is operating 46 and its steel ingot capacity is now operating 75 to 80%. A notable feature is that unfilled orders are piling up in a mid-summer month that is usually very dull. There are higher prices in a few lines such as wire products for export, for black sheets and galvanized sheets. Bar mills are pretty well sold up. Some steel companies have sold about 150% of their July capacity and bookings are unbalanced because less than capacity in plates, large bars, and railroad material. It appears that the actual return flow of common labor to Europe has been exaggerated, but there is a scarcity of skilled labor. French steel works engineers are negotiating here for equipment to rebuild two plants, involving $8,000,000, and it is stated that electric furnaces are to be an important item.

COPPER

After several weeks of brisk demand and an active business at constantly rising prices, the last week has witnessed a marked slackening in the pace—a really healthy condition. But a fair business has been done and the market is very strong with prices firm and unchanged. While electrolytic copper for early delivery is scarce in some quarters it can be obtained in substantial amounts at 23.50c., New York, for August delivery, which we quote as the market. For spot delivery, 24c. rules with 24.25c. at least asked for October where obtainable. Most sellers are refusing to quote beyond October, although demand is excellent for the last quarter, and some will not sell for October. Lake copper is rather scarce but is quoted at 23.75 to 24c., New York, for August delivery, with futures at a premium.

TIN

The fact that exchange rates on England have tended recently to become stronger as against the low point reached a week or 10 days ago has had a firming effect on tin prices here, and the market is stronger. It is still, however, rather quiet. Prices have been erratic due to the fact that some sellers still fear the possibility of lower prices for the pound and refrain from selling while others are conservative and have been doing some business which has resulted in the higher prices. In the last week a little business has been done but not much—perhaps 300 to 500 tons, mostly for future delivery. Prices on Monday for future shipment from the Straits were: July, 53.50c.; August, 53c.; September, 52.87½c.; October, 52.50c. American pure tin is selling at about 68c. with the 99% grade at about 66c., New York. Spot Straits tin, from the allocated metal in consumers hands, is nominal at 70 to 70.50c., New York, with very little moving.

LEAD

Another advance in the price of lead was made July 24, when the American Smelting & Refining Co. raised its quotations from 5.75 to 6c., New York. The independents at once met this and are offering the metal at 6c., New York. The market is quiet and firm at present with quotations for August delivery held at 5.75c., St. Louis, or 6c., New York. It appears that lead from second hands or dealers is now coming into the market at 6c., New York, and intimations are to the effect that this price may be shaded slightly in order for dealers to make sure of their paper profits.

ZINC

The market has turned very quiet and demand has tapered off decidedly. In fact a slight reaction has been experienced and prices have receded until today prime Western for early delivery is quoted at 7.70c., St. Louis, or 8.05c., New York. Although the metal is obtainable at this level it is understood no sales have been made at less than 7.85c., St. Louis, or 8.20c., New York. Without doubt most of the recent business has been taken by dealers and it is thought by some that these stocks have been pretty well exhausted. It seems certain that producers in general are not sellers at present prices but are confidently waiting an upward trend in the near future.

ANTIMONY

The market is strong but quiet with Asiatic grades quoted at 9.25 to 9.37½c., New York, duty paid, for wholesale lots for early delivery.

ALUMINUM

Quotations are unchanged at 32 to 33c., New York, for wholesale lots of No. 1 virgin metal, 98 to 99% pure, for early delivery.

ORES

Tungsten: The week has been a quiet one. Prospective sellers are not anxious to part with their material, hoping that future demand from German-Austrian sources will strengthen the market. Quotations are nominal at $7 to $15 per unit in 60% concentrate, depending on the grade and the delivery. There is still no test of the ferro-tungsten market reported and it is probable that the alloy can be bought at about $1.15 per pound of contained tungsten.

Molybdenum: A small business is reported at 85c. per lb. of MoS_2 in 90% material. The market is lifeless.

Manganese-Iron Alloys: Domestic ferro-manganese, 78 to 82%, is still quoted at $115, delivered, with business confined to carload and 100-ton lots for early or spot delivery. The British price is $105, seaboard, but it is probable this would be met on desirable business at $110, delivered, from American makers. Spiegeleisen is quiet but strong at $35, furnace.

A field for possible use of steel products is opened up as the result of a movement to require substitution of metal or some other product for wood in making railroad ties. The question was presented to Congress in a resolution introduced by L. C. Dyer, Representative from Missouri, and is now being considered by the House committee on interstate and foreign commerce. Investigation by the Interstate Commerce Commission is urged with a view to recommending legislation by Congress. The substitution of steel for wood for railroad ties, even in part, would require a vast steel tonnage and greatly add to the demands on the steel industry.

INDUSTRIAL PROGRESS

INFORMATION FURNISHED BY MANUFACTURERS

INTERNATIONAL MINING MACHINERY EXPOSITION

Some weeks ago an announcement that the Merchants and Manufacturers Exchange was to take over Grand Central Palace, New York, for the purpose of turning it into a big trade clearing house, caused considerable comment in many lines of industry, especially the mining world. This announcement has now been followed by another, that one of the big permanent expositions will be the International Exposition of Mining Industries. This branch of the exposition is expected to fill a long-felt want

Grand Central Palace, New York

in its field, particularly in the development of foreign and domestic trade. It will include all that is latest and best in machinery used in the development and exploitation of metal mines, non-metal mines, and oil wells, as well as machinery used in the subsequent extraction, reduction, or refining of the raw products by concentration, leaching, cyanidation, flotation, smelting, distillation, coking, and similar processes. The manager will be Howard R. Ward, a mining engineer who has practised in the West for the last 15 years. Prior to entering war work he was for three years consulting mining engineer with the American International Corporation, and in addition to his mining work was associated with the organization of its machinery export companies both home and abroad. Inquiries should be addressed to Suite 421, 405 Lexington Ave., New York City.

The new enterprise has sound backing. The Nemours Trading Corporation, of which Alfred I. du Pont is president, owns and controls the Merchants and Manufacturers Exchange. It has, in the leading cities of the world, 19 branch offices and 3000 foreign selling agencies. Through representatives of the Nemours Trading Corporation inquiries from many parts of the world where machinery and other commodities are desired will be referred to the Merchants and Manufacturers Exchange, and those pertaining to mining will be referred to the Mining Exchange. Exhibitors of the specified lines of goods will be notified.

COMMERCIAL PARAGRAPHS

The Ivanpah Copper Co., of Cima, California, is installing a large surface tram which was sold to it by **Collins & Webb**, machinery dealers, of Los Angeles.

Camden Forge Co., Camden, New Jersey, has established a New York district sales office at No. 2 Rector St., with Samuel W. Hilt as manager.

The Westinghouse Elec. & Mfg. Co. has issued a publication covering electric arc welding and accessory apparatus. Different processes of welding, such as autogenous, forge, oxy-acetylene, and thermit are compared with the electric arc.

The Mine & Smelter Supply Co. has issued a catalogue describing the Ruth laboratory testing flotation machine. Sizes, types, and principles, are fully illustrated and described. Copies may be obtained from any of the company's offices.

John D. Hoff of the Hoff Magnesite Co., Inc., of San Francisco, has been granted patent No. 1307974 for a magnesite kiln which is constructed for the special burning of magnesite when the calcined magnesite which they manufacture is to be used for plastic flooring and stucco work.

United Filters Corporation has established a sales office at 35 Montgomery St., San Francisco, under the direction of the Western Steel & Engineering Corporation. In addition to this office, the company's activities on the west coast are also taken care of by Kennard & Bierce of Los Angeles and the United Iron Works of Spokane, Washington.

Announcement is made of the removal of the Minneapolis office of the **Chicago Pneumatic Tool Co.** from the Metropolitan Bank Bdg. to Fifth avenue and Fifth street South, Minneapolis, Minnesota, where a complete stock of pneumatic and electric tools, air-compressors, oil-engines, and rock-drills and parts therefor will be maintained.

Phillips J. Jarvis has resigned his position as sales manager for the St. Louis office of the **Sullivan Machinery Co.** The following appointments are announced: Marion C. Mitchell has been appointed sales manager for the territory in Indiana and Illinois previously controlled from the St. Louis office, with temporary headquarters at Room No. 2006, Railway Exchange, St. Louis. Don M. Sutor, formerly manager of the El Paso office, has been apointed sales manager for the territory of western Kentucky, western Tennessee, Missouri, Arkansas, Oklahoma, and Kansas (except the

oil territory), with headquarters at Room No. 2006, Railway Exchange, St. Louis. Daniel H. Hunter has been appointed sales manager for Louisiana, Texas (except the south-western section), and the oilfields of Oklahoma and Kansas, with headquarters at Dallas, Texas.

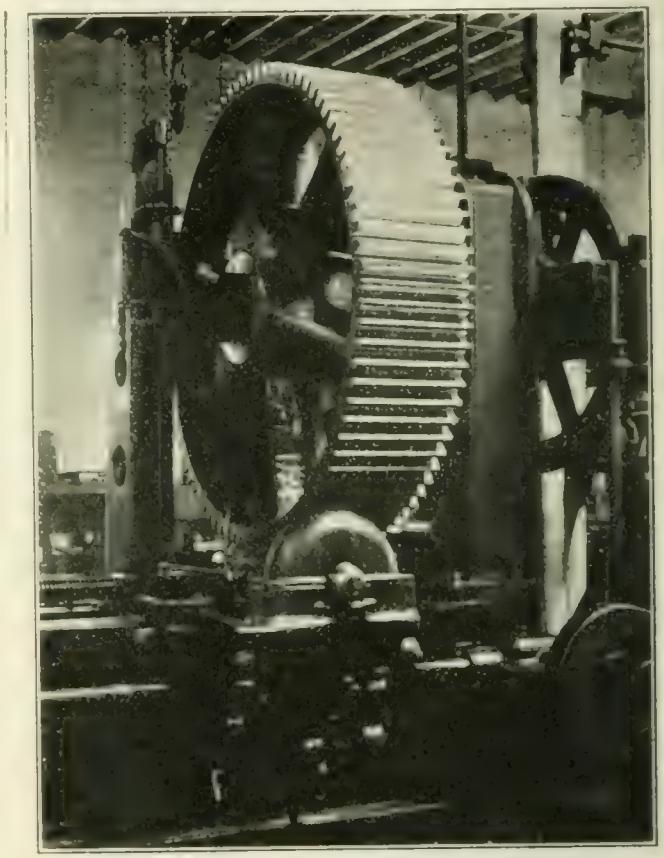
'Concentration' is the title of a new catalogue which has just been compiled and published by **Allis-Chalmers Mfg. Co.** This catalogue, in addition to containing detailed descriptions of the various classes of concentrating equipment, also contains a large amount of valuable data on the crushing and concentrating of ores. It is profusely illustrated, showing not only various types of machinery entering into ore-milling practice but also flow-sheets of numerous representative milling plants. This present catalogue presents a very complete digest of modern milling practice and will be sent to those interested upon application to the Allis-Chalmers Mfg. Co., Milwaukee, Wisconsin.

Among recent shipments made by the **Overstrom Manufacturing Co.**, of San Francisco, were 17 Universal concentrating tables to the Seoul Mining Co., Chinnampo, Korea, and the entire table equipment for the Salina Mining Co., of Zinc, Arkansas, including roughers, coarse-sand tables, fine-sand tables, and slimers. Other shipments of Universals have recently been made to the following: Blair Mines Co., Blair, Nevada; Chief Cons. Mines Co., Eureka, Utah; Smuggler Leasing Co., Aspen, Colorado; Chocaya Cia. Oploca de Bolivia; Crescent Lead & Zinc Corp., Waco, Missouri; Golden Age Junior M. Co., Centerville, Idaho; Original M. & M. Co., Clearinghouse, California.

The aerial tramway being installed by the **A. Leschen & Sons Rope Co.** of St. Louis for the Cia. Beneficiadora de Pachuca, S. A., is nearing completion. This is one of the most notable aerial tramway installations in Mexico, the line being about 4½ miles in length and built in two sections with an angle station about midway. This station also serves later as an intermediate loading station. The initial capacity of this tramway is 60 tons of ore per hour with an ultimate capacity of 100 tons per hour. Locked-coil track-ropes are used and the Leschen patent flattened strand traction rope. The carriers are of 16 cu. ft. capacity. Good progress has been made in the erection of the aerial tramway for connecting the Walker mine with the Western Pacific railroad at Spring Garden. This tramway has the following principle features: length, approximately 9 miles; elevation loading terminal, 6000 ft.; elevation discharge terminal, 4000 ft.; elevation high point, 7000 ft.; initial capacity, 6 tons concentrate per hour; ultimate capacity, 12 tons concentrate per hour. The tramway is of the Leschen heavy-duty friction-grip type. There will be 8 tension stations and 104 towers. The track ropes are to be of 1⅛ and 1 in. diameter of locked-coil construction and the traction rope ¾ in. Hercules red strand. The carriers for handling the concentrate will be 6 cu. ft. capacity and there will be special carriers for handling merchandise and supplies from the railroad to the mine.

The Llewellyn Iron Works of Los Angeles has issued a handsomely illustrated booklet descriptive of its plant equipment, manufacturing facilities, and the variety of products turned out by its organization. Views of both the Los Angeles plant and the Torrance, California, plant are shown. The booklet features the construction of marine equipment, in the manufacture of which the Llewellyn company made an especially fine record during the War. Practically everything that goes into the construction of marine engines is manufactured within its own plant. The Torrance works includes the Llewellyn open-hearth steel furnaces and rolling mills, steel foundries and gray-iron foundries, having a maximum capacity of 50 tons per day. The main offices of the company, together with the machine-shops, forge-shops, boiler, tank, and structural shops, are situated at the Los Angeles plant, where the castings and fabricated shapes from the Torrance plant go through the successive manufacturing processes whereby the finished articles are turned out. The company manufactures marine engines and boilers, stationary boilers, tanks, cranes, hoisting machinery, elevators, mining and sugar machinery, foundry and rolling-mill equipment, water towers and pipe, machinery for gas works, oil refineries, towers for wireless stations, and structural steel for viaducts, bridges, and buildings. The Llewellyn company has specialized for many years on mining and milling machinery, and has manufactured and erected some of the largest plants in the South-West.

The illustration herewith is an interesting example of the development of the gear cutting industry in San Francisco. The view, taken in the plant of the **Johnson Gear Works Co.**, of San Francisco, shows a spur gear in process of cutting in one of the larger machines with which this plant is equipped. The gear is 58-in. pitch-diameter, 87 teeth, 10-in. face, and 1½ diametral pitch. The blank is made of cast steel. The company has specialized on the manufacture of machine-cut gears only, and has made an exceptionally fine record in small work where the greatest precision is required, as, for example, in the case of the heat-treated gearing for air-craft internal-combustion engines. Gearing for mining and milling machinery is another specialty to which this company has given particular attention, and by reason of its facilities for turning out a large variety of skew, herringbone, spur, bevel, worm, mitre, and rawhide noiseless gearing, it is able to effect quick and accurate replacements of gearing for emergency work on short notice. The plant is open to inspection by interested visitors, and mining men are invited to take advantage of this opportunity and thereby inform themselves as to the facilities offered by this company for the accurate execution of orders within their line of manufacture



Cutting a Large Spur Gear

ON August 7 the Senate passed the House joint resolution, Number 76, by which annual assessment work on mining claims during 1919 is suspended. The suspension of this regulation under the mining law was requested by Senators Poindexter and Phipps on account of the scarcity of labor. This exemption from assessment, however, is limited to five locations of any single claimant.

PROSPECTORS may be reminded that by Congressional enactment of the Indian Appropriation Bill, all unallotted lands within the Indian reservations in Arizona, California, Idaho, Montana, Nevada, New Mexico, Oregon, Washington, and Wyoming are now open to lease by citizens or corporations of the United States for the purpose of mining. Claims are to be located in the usual manner, but the locator must file application for a lease within a year and pay rental ranging from 25 cents to one dollar per acre per annum, this rental to be credited against the royalty as it accrues for each year. The leases are for a term of 20 years, with the right of renewal, and a royalty of not less than 5% on the net value of the mineral output must be made to the Government for account of the Indians.

BLUE SKY LAWS are being evaded, says the Commissioner of Corporations in California, Mr. C. E. Bellows. "The corporations that find it necessary to evade the provisions of the Corporate Securities Act," says he, "are not organized for the benefit of the investing public," meaning the legitimate speculator. He is referring chiefly to the oil stocks, representing wild-cats, that are trying to entice the simple and unwary in California. It is not necessary for us to quote the list appearing in his recent circular, because our readers are too intelligent to be victimized by such schemes. However, we would advise anybody buying stock in oil or other mining enterprises to address themselves to the Commissioner of Corporations at 815 Flood building, San Francisco, for the sake of being well advised beforehand.

FOLLOWING the interesting article by Mr. J. J. O'Neill on 'Deposits of Native Copper in Arctic America', appearing in our issue of June 14, and Dr. Willet G. Miller's remarks, in the preceding issue, on the prospects of finding ore in the pre-Cambrian shield of Northern Canada, we are glad this week to publish an article, by Mr. Ellsworth Y. Dougherty, on the relation of regional deformation to the distribution of ore in this pre-Cambrian terrain. Mr. Dougherty reviews structural conditions in the principal mining districts, namely, Sudbury, Cobalt, and Porcupine; he does it in such a way as to afford guidance to the prospector, a man who deserves all the help that the geologist can give him. The localization of ore deposits is, of course, the subject appealing most directly to the mining engineer. To this also Mr. Dougherty contributes sundry useful hints. Theories may not lead directly to the finding of ore, but they stimulate intelligent observation.

STANDARDIZATION of the symbols used for mine maps has received but scant attention in this country, and as a result maps made in one district are imperfectly understood in another until considerable time has been spent in the study of the various symbols used. Although many of the individual companies have established their own symbols—we recall one set, devised by the International Nickel Company, that was distributed rather widely—nevertheless there has been no general acceptance of symbols throughout the country. Mr. L. C. Uren, Associate Professor of Mining in the University of California, appreciates this fact, and, as the result of a good deal of earnest and thoughtful work, has compiled a set of standards containing the symbols in most general use, which we take pleasure in publishing in this issue under the title 'Conventional Symbols for Mine Maps'. Professor Uren has had the opportunity of comparing the advantages and disadvantages of a large number of symbols collected from many districts, and has selected those that seemed to him the best. We know how greatly, even at a single mine, the mapping can be improved by having the draftsmen conform to the same practice, and we appreciate that it would be much more advantageous if, as is done on the Rand, a uniform style could be accepted. Professor Uren's compilation is the best that we have seen, and we commend it to the attention of all engineers interested in the improvement of this branch of technique.

IN a statement of stock recently admitted to the list of the New York Stock Exchange we note that the issues of two companies are "without nominal or par value." Thus is again acknowledged the fact that the par value of a stock bears no relation to its actual value.

We hope this obvious principle will some day be more clearly recognized, or, rather, more frequently acted upon by mining companies, particularly those in an embryonic stage of their development. The idea has been adopted in one or two instances; the ore assured being represented by debentures, bonds, or preferred stock, whereas the future prospects were represented by stock of no fixed valuation. It is especially desirable that new flotations of dubious worth should not be coupled with the suggestion of their having definite value, thereby stimulating the imaginations of the unsophisticated, who becoming confused over an issue of "1,000,000 shares of a par value of $10, for sale for the next three days only at 10c.", wander from the wayside and become entangled to their sorrow in the quagmire of low finance.

DEPRESSION in Rand gold-mining affairs has reached the point where a writer in the 'South African Mining & Engineering Journal' asserts that unless matters change for the better Johannesburg within thirty years will be "a modern Zimbabwe," the reference being to the ruined cities of Mashonaland described by Mr. Theodore Bent. The trouble is with the low-grade mines, which are threatened alike by impoverishment in depth and by the increasing cost of exploitation, particularly taxation and labor. Of the 38 mines in operation, 16 are working at a loss; and these employ 5545 Europeans. The total working profit of the Rand, excluding the eight rich mines of the Far East Rand, was only £365,000 in the three months ending February 28, 1919. So says Sir Evelyn Wallers, the president of the Transvaal Chamber of Mines. In reply to his protests, the Secretary of Mines suggests the appointment of a commission of inquiry—which is the customary device of perplexed governments.

HIGH cost of living for professional men is aggravated by the cost of high living, as we have suggested more than once. This is due in part to the extravagant ways of living induced by the easy money made by a small minority of our citizens who buy things with the irresponsibility of a drunken sailor. This line of thought is revived by seeing a list of Stock Exchange quotations, showing the range of prices during the last five years. During this interval many stocks have risen in value so greatly as to have afforded numerous chances of making 'easy money'. For example, International Mercantile preferred has risen from $3 to $118.50; Atlantic & Gulf from $6 to $167; American Hide & Leather preferred from $17 to $132.50; U. S. Industrial Alcohol from $16 to $141; and General Motors from $58.75 to $227 per share. Twenty industrial stocks show an average rise of over 100%. This means that a considerable number of men have made fortunes without performing any useful service to the community; they have simply gambled luckily. Wall Street serves a useful function as a market; it promotes industry by facilitating corporate enterprise; but much of its hectic activity is no better than that of a casino; it is an industrial Monte Carlo, to which are attracted large numbers of clever men whose abilities are directed into an unproductive channel. Scores of citizens of first-rate ability, potential captains of industry, clever executives, and able administrators, spend their time with the ticker and the tape. The number of dynamic men drowned in the maelstrom of Wall Street represents an enormous economic loss to this country. Gambling is bad for all concerned—the winner, the loser, and the community. Speculation is inseparable from the hazards of industry; but gambling is not essential; it is demoralizing. One of the after-effects of the War has been the wild spending of money by a host of fortunate gamblers and profiteers, whose activities have been detrimental to the community both in their manner of winning wealth and in their way of using it. Wall Street is a necessary institution, but it needs discipline.

Gold, Prices, and Debts

On another page we publish a timely and incisive contribution on this subject from the pen of Mr. R. B. Brinsmade, who has enriched our pages more than once. Supplementing the figures quoted by him in regard to the rise in prices, we may state that, according to the Bureau of Labor Statistics, the average increase in the cost of food-stuffs has been 88% since 1913; of wearing apparel, 120%; of fuel and light, 45%; and of furniture and furnishings, 125%. The dreary science of economics has begun to interest all of us; on every side are heard angry protestations against the incidence of prices that undermine the happiness of the home. Mr. Brinsmade writes as a professional man, as the representative of a class that stands between the devil and the the deep sea, between the entrenchments of capital and the advancing barrage of the labor-unions. We share his opinion of the orgy of profiteering associated with our participation in the War and the inadequacy of the small profit-tax to adjust the account established by price-fixing, which served largely to justify the arrogance of the labor-unions, themselves representing less than 10% of the workers in this country. After all, in discussing the current crisis in the cost of living, it cannot be insisted too often that it is a sequel of world-wide disturbance of values caused by the War. The destruction of life, which represents labor, and of material resources, which means capital, has been enormous. We may be amused at the adroit use made of this argument by the President, when he stated that the lowering of the cost of living is linked with the ratification of the Treaty of Paris and the Covenant of the League of Nations, but we must concede the fact that the world is waiting for the conclusion of international negotiations before it can turn with any sort of confidence to normal industrial activity. In this country we may 'forget' the War and proceed lightheartedly about our business, but in other countries, in which we buy and sell, the effects of the last five years have been incomparably more serious and the dislocated elements of enterprise have yet to be re-assembled, the

confidence of industry reestablished, the channels of commerce reopened. Our national life has been so little disturbed that we are forgetful of the plight of the countries whose manhood has been decimated, whose manufactures have been paralyzed, and whose credit has been crippled. We agree that one step—but by no means the only one—toward a restoration of normal costs is to expedite the ratification of the Treaty and the Covenant, so as to make way for policies of reconstruction. In his speech, which was much more to the point than most of his public utterances, the President laid stress on the vicious circle by which the raising of wages only leads to the increased cost of other things. Indeed, if the price of everything could be increased proportionately, we might be less likely to complain, although it would play havoc with the relations of debtor to creditor as established before the higher cost of living came into effect. The facts concerning the storage of foods and their market price speak eloquently for the absence of proper regulation in the distribution of the necessaries of life. Our entire system of distribution, local as well as transcontinental, is glaringly inefficient, and it plays into the hands of manipulators and profiteers. It seems reasonable to suppose that some of these defects and wrongs can be corrected by means of legal enactments already available for that purpose, and it is fortunate that some of the measures for price-control placed in the hands of the Government during the War are still at its service at this time. During the War, we saw, as was to have been expected, much extravagance and a good deal of blundering, but some things were done well, among which the work of the Food Administrator was honorably conspicuous. If the markets could be controlled reasonably and if the distribution of food-stuffs could be regulated effectively during the War by the Food Administration, it should be possible to do something of the kind in time of peace.

The War Minerals Relief Scandal

We return to this subject because it is vital to a large number of miners in the West and concerns a matter of public policy that ought to interest every citizen. We regret to observe several signs of an effort on the part of Government officials to over-zealousness, verging on cheap smartness, in the interpretation and administration of the Act passed by Congress for the purpose of compensating those who, in response to a patriotic call, engaged in the production of chrome, manganese, pyrite, and tungsten, and who, in their attempt to fulfil a national duty, suffered financial loss, chiefly through the bungling of the Ferro-Alloys Section of the War Industries Board last year. In our issue of July 19 we criticized the way in which the Secretary of the Interior, in whose hands the administering of the Relief Act was placed, 'passed the buck' to the Attorney-General, and the latter's technical interpretation of the Act in such a way as to exclude from relief a large number of miners who were importuned to produce the needed minerals by the press propaganda of Secretary Lane himself. We note that the Relief Commission, now in session at Medford, Oregon, has received a letter from Mr. Henry M. Parks, the Director of the Oregon Bureau of Mines, in which he testifies to having ordered the field staff of his bureau "to do everything possible to encourage new development, and speed up the production of manganese and chrome." According to the Attorney-General's ruling, the fact of engaging in the mining of these minerals at the instance of the Oregon Bureau of Mines will not suffice to justify the award of compensation, because the claimant cannot prove that he had been "asked specifically by one of the five Government agencies named in the Bill." Yet Mr. Parks testifies that in October 1917 he received a letter from Mr. George Otis Smith, Director of the U. S. Geological Survey, requesting him "to exert every effort to increase the domestic production of chrome ore" and "to this end," Mr. Smith added, "the hearty co-operation of your organization is earnestly invoked." Is the Government to go back on Mr. Parks and the members of his staff, stultifying and dishonoring them in the eyes of the men who trusted in them and believed them to be authorized in their efforts to stimulate the production of chrome and manganese in Oregon? Legal gentlemen say that 'good conscience' should determine the validity of claims; we ask what kind of conscience has an official who distinguishes between a request made by "one of the five Government agencies named in the Bill" and a request made known by persons to whom the said agencies appealed for help in advertising their urgent demands, whether it be the director of a State bureau in Oregon or the editor of a respectable paper in San Francisco. In our issue of August 2 we criticized the nature of the cross-examination to which claimants are being subjected by the Relief Commission. There is this further point to be made, that the claimants for larger amounts are able to present briefs prepared by a competent lawyer and they go before the Commission accompanied by a lawyer, so that the amiable attempt to subject them to a crude and misleading psychological test does not succeed, although it does succeed in raising an entirely false issue when applied to the less sophisticated claimants.

Now we come to another unpleasant phase of this affair. We are informed that Mr. J. E. Spurr, Chief Engineer for investigative work under the Act, insists upon having all reports sent to him direct at Washington. When the Relief Bill was passed, a corps of examiners was organized for the purpose of scrutinizing the correctness of the claims presented to the Commission. The reports of these examiners are essential to the adjudication by the Commission, yet the Chief Engineer has refused to allow this necessary information to be given promptly to the Commission, insisting upon the reports being sent to Washington, to be abstracted by him, thereby further delaying the awards, which in any event are going to be unconscionably belated. What is worse, he has seen fit to dismiss an engineer for telling the truth. We regret to make this strong criticism, be-

cause the Chief Engineer has just arranged to become the editor of our competitor at New York, but this is a matter too important to be set aside on personal grounds; it concerns the profession deeply, as will be shown. Among the engineers retained by Mr. Albert Burch, acting for the U. S. Bureau of Mines in its campaign to promote the production of war minerals, was Mr. R. H. Toll, whom we have known for 20 years as an intelligent, trustworthy, and honorable mining engineer. In the performance of his duty he told Mr. L. R. Payne, of Fresno, of the need for intensifying the production of chromite and of the Government's intention to protect the producer by market control. At Mr. Payne's request, he confirmed his verbal statement by a written one to the same effect. This letter was submitted by Mr. Payne as part of his evidence when he presented his claim for compensation to the Commission. Meanwhile Mr. Toll had been again engaged by the Government, this time as an examiner under the Relief Act, and he was doing his work when he received the following telegram from the Chief Engineer: "With reference to claim 480 L. R. Payne & Co., Fresno, California, on March 12, 1919, you wrote the manager a letter in which you state 'In addition to patriotic motives in doing this you had the assurance of the Government through me that you would be protected at least a year on the prevailing market price.' You must be aware that no branch of the Government ever gave such assurance or had the authority for so doing and that you have no authority to make this statement; under the circumstances it would evidently be better if your present temporary appointment, which expires July 31, should not be renewed; will you turn over the claims and data which you have on hand to Mr. Hyder who will leave for San Francisco within a few days." Whereupon Mr. Toll replied by quoting from two statements made by the Chief Engineer himself and now to be found in the records of the Relief Commission. The first was a telegram of August 8, 1918, to Mr. Burch, as follows: "War Board in Washington are all agreed that California chrome production shall be maintained and are ready to take whatever steps are necessary. Just what these steps [are to be] will be determined promptly." The second was a letter of September 30, 1918, to Mr. Charles H. Holbrook, as follows: "Reply to your letter of September 12th has been delayed pending a survey of the chromite situation by various Government departments. The War Industries Board telegraphed to Mr. Burch of San Francisco as follows: 'It may be announced that it is the present intention of the War Industries Board to arrange for continued production in the United States for the first half of 1919 at the rate proportionate to the rate of 1918 production, and the trade will be asked to purchase chromite produced in the United States during the first half of next year at this rate.' No doubt machinery for carrying this program into effect will be devised by the War Industries Board." On September 27, 1918, Mr. H. W. Sanford, chief of the Ferro-Alloys Section of the War Industries Board, telegraphed a little more explicitly: "It is the present intention of the War Industries Board to arrange for continued chromite production in the United States for the first half of 1919 at a rate proportionate to the rate of 1918 production, and the trade will be asked to purchase chromite of suitable grade produced in the United States during the first half of next year at this rate. No announcement can be made regarding prices. Believe tonnage of domestic chromite produced during the balance of this year can be sold at the average prices paid this summer by the California Chrome Company. If unable to find ready market for ore, wire this office, giving tonnages ready for immediate delivery and guaranteed analysis and prices wanted and to whom already offered and refused. Chemical refractories and steel trades likely buyers." This telegram was addressed to the President of the San Francisco Chamber of Commerce. The references to 'market' and 'rate' made in the statements of Government agents have no meaning, of course, unless they signify a price at which the products mentioned could be sold remuneratively. It seems to us that Mr. Toll was justified in the statement he made to Mr. Payne in June 1918, and confirmed by letter subsequently. Mr. J. S. Diller and other representatives of the Geological Survey told the Californian miner to start the mining of chrome before the War Minerals Bill was passed; the miner in the hills was told that it was "as good as passed"; in the Bill it was stated: "The Secretary of the Interior, with the approval of the President, is authorized from time to time to enter into contracts for necessaries for periods not exceeding two years," which was an implicit guarantee of a profitable market for at least two years. One of the oldest games in the world is for a superior to tell a subordinate to do something and then fail in moral courage to back him up later. Mr. Toll's statement to Mr. Payne was based on what he had been told by those in charge of the chrome propaganda; it was made in good faith both to the Government and to the chrome miner. Is a professional man expected to say one thing to the buyer and another to the seller? Is he a mere hireling?

These people at Washington do Uncle Sam small honor if they suppose that so frank, big-hearted, and honorable a gentleman could desire his servitors and assistants to employ such pawky tactics. It appears that the new editor of the 'Engineering and Mining Journal' is to follow in the tradition of his predecessor, who opposed both the War Minerals Bill and the Relief Bill, which was its logical sequel, and, not content with such opposition, has seen fit to sneer at the miner of the West as a 'profiteer' and 'patrioteer'. One word more, to summarize the whole affair: what would be the attitude of the miner, not to the Government, but to the representatives of the Bureau of Mines, Geological Survey, and Department of the Interior, if the United States became involved in another war, calling again for an intensive production of sundry minerals? What would the miner say to these gentlemen? His language, like that of Bret Harte's hero, would be, we venture to guess, "painful and free".

Gold, Prices, and War Debts

The Editor:

Sir—I have been much interested in the extended discussion upon the status of gold. Messrs. Van Dyck, McPherson, Robbins, and Benedict have so thoroughly covered the subject that I would not venture to enter the controversy at this stage did I not believe some points have been overlooked whose elucidation may tend to harmonize the present discord.

First, as to 'value' and 'price'. The statement of Mr. McPherson is ambiguous when he says[1] "Any metal, gold included, derives this [social and intrinsic] value from the amount of social human energy and time expended in its production." If by 'value' he means its market price as a commodity, as measured by the quantity of other commodities for which a pound of metal will exchange, he is evidently mistaken, for this 'value' of any metal is fixed by its cost of production at the marginal class of mines. The 'marginal' class of mines may be defined as the leanest one that has to be worked to supply the current market demand. It is therefore not a fixed class, but will comprise leaner or richer mines according as the market demands more or less of the metal. In the case of the monetary standard, gold, its exchangeable value has been arbitrarily fixed in legal tender by government fiat, and this creates an unlimited demand for it and places within the marginal class of mines all those whose cost of production is around $20.67 an ounce. The price in money of their product being thus fixed by law, the class of marginal gold mines changes much slower in its personnel than those of the other metals whose output is exposed to all the fluctuations in price of a competitive market.

It is a curious fact that this marginal theory of prices is ignored by many so-called economists. It is simply a corollary of Ricardo's well-proved 'Law of Rent',[2] whose disregard by Karl Marx in his first two volumes of 'Capital' explains the founding of the Socialist party of Europe, in the early 'seventies, on a quite false economic base. Marx's rectification of his early mistake was only published, posthumously about 1893, in his third volume of 'Capital' and it was then too late to change the economic program of political Socialism, whose recent practice on a large scale has wrecked the industries of Russia.

To date, there have really been broached three distinct problems in this gold discussion, namely: (1) Is it desirable that the price of labor and commodities be indefinitely maintained at the extraordinary high level reached in later 1918? (2) What is the future prospect of the formerly productive gold mines that are now thrown into the sub-marginal class by war costs of production? (3) How can the huge national war debts be equitably settled?

Messrs. Van Dyck and Robbins answer the first question in the affirmative and thereby favor the debtor class in general and the war-debtor nations in particular. But to rescue the gold mines that have been knocked out by these desirable high prices, they propose nothing less than the increase of the mint price for gold, which plan is truly characterized by Messrs. McPherson and Benedict as a debasement of the coinage anciently known as coin-clipping. The chief defence of Mr. Robbins[3] for his startling proposal is that in 1812, when the present mint value of gold was fixed in England, a British consol of £100 could buy 100 gold sovereigns, while now it will only buy 59. If a consol sells for £80 in gold, Mr. Robbins claims that the value of labor has risen 25% since 1812, but to prove this it must first be shown that the rate of wages varies with the rate of interest, on which the market-value of consols depends. It seems to me that the recent great fall in consols indicates nothing as to wages, but simply shows a rise in the rate of interest, as would naturally be expected as a result of the destruction of a large fraction of the world's capital by the War.

For many reasons the high price-scale of 1918 seems to be most undesirable. Few appreciate the rapidity of the rise in the cost of living that took place mostly just before and after the United States entered the War. From Dun's index numbers,[4] based on the price of 300 commodities of which foods count 50%, textiles 18%, minerals 16%, and miscellaneous the balance of 100%, we find that the index for the total cost of living was 100.3 in 1905, 124.5 in January 1914, 124.2 in January 1915, and only 137.7 as late as January 1916. Toward the end of 1916 began the skyrocket rise that carried the index to 169.6 on January 1, to 190.0 on April 1, to 204.8 on May 1, and to 220.7 on November 1 of 1917. In 1918 the rise was less rapid, as it only went from 222.2 on January 1 to 233.2 on October 1 as the maximum. From the standpoint of social adjustment this increase in the cost of living of 60% between January 1916 and November 1917, was a catastrophe. While most war manufacturers and labor unions profited by the change, or at least

[1] M. & S. P., March 22, 1919, p. 382.
[2] 'Political Economy', by Charles Gide.
[3] M. & S. P., March 22, 1919, p. 383.
[4] 'The Outlook' 1919, p. 746

broke even the great middle class of teachers, clerks, and professional workers, along with those living on fixed incomes, found their means of livelihood nearly cut in two through no fault of their own. The whole creditor class was badly wronged also by the decreased purchasing power of their capital. Although Mr. Robbins seems to have little sympathy for such 'holders of securities', it should be clear to any unbiased student that the ideal condition is a constant index of prices favoring neither debtor nor creditor in the settlement of long-time obligations. Even when after years of suffering and struggle the wage-scales of society may have become adjusted to the 1918 scale of prices, there would yet remain the stigma of general defrauding of creditors to be palliated by those advocating the maintenance of this scale by artificial means, like debasing the coinage.

But however desirable a return to the former price-index may be, our hope is vain because "we are on a permanently higher price-level," according to Professor Irving Fisher,[6] who attempts to prove his bold assertion by his favorite theory regarding the abject dependence of prices upon the quantity and rapidity of circulation of money;[7] although no serious student can doubt that the quantity of money in circulation has an important effect on prices, there are other factors which, at times, may be even more weighty, and chief among these recently have been scarcity and price-fixing.

Cheerfully granting that the rise in Dun's index from 100.3 in 1905 to 124.2 in January 1914 was mainly due to a world increase in money circulation, I refuse to follow Professor Fisher beyond this point. How minor a factor was the expansion of credits and circulation on the war-index is shown by the fact that in January 1915, after five months of conflict accompanied by the first huge public loans and the virtual suspension of specie payments by both sides, the index was at the same level as a year previously. A year later, although the same loan and paper-money policy was ever being extended, the index had advanced only to 137.7 and a growing scarcity of commodities—owing to the steadily increasing destruction and the diversion of productive labor to the armies—can easily account for this 10% rise. Even more does scarcity explain the 16% rise of the index to 169.6 at the end of 1916, for this year was marked by the expansion of the army of the most productive of the Allies—Great Britain—to 5,000,000 men.

The 10% advance of the index to 190 in the first three months of 1917 is easily explained by the introduction of the new factor of lawless submarine warfare on February first. The submarine then hindered ocean traffic as much by its menace as by its actual destructiveness, however appalling. After the United States declared war on April 6, the index jumped another 10% to 208.4 within a month, and this was caused by a new stimulant to scarcity, namely, the diversion of a large part of the productive power of the United States, hitherto engaged in supplying civilization, to the equipping of a huge new army and navy.

For the advance of the index by another 5% to 220.9 in November 1917, an important new factor was added to the previously dominant one of scarcity, namely, the inauguration of price-fixing by the American government. It is true that price-fixing had been practised more or less by our European allies since 1914, but the fact that a large part of their extra supplies had to be bought abroad, in markets unaffected by their price-fixing, rendered its influence on the index of prices of mainly a local nature. There were two plans under which our Government could fix prices with the object of a maximum stimulation of production. The first proposed to fix the price at the cost of production of the marginal producer, and this involved an abnormally high figure, for the maximum production meant the extension of the margin of production sufficiently to include the worst and most inefficient plants. The second plan involved the fixing of a price covering the costs of the efficient plants, which would produce the bulk of the requirements, enabling the smaller and poorer plants also to operate by granting them a bonus on their output, from public funds, to cover their higher cost of production.

The second plan would have implied a lower price for both civilian consumers and the Government, and would have meant a much less expense for the latter, for the bonus to inefficient producers paid on only a fraction of the purchases. On the excuse that the second plan was "impracticable to administer," an objection that had force only for a widely extended industry like wheat-raising, the first plan was adopted, and its evident unfairness, both to taxpayers and consumers, was to be obviated by recovering most of the consequent huge profits of the producers by an excess-profits tax. Another excuse was that the war demand from Europe had already placed munition prices at a high level, and that to attempt to fix prices on the basis of actual costs for the bulk of production was something quite too Utopian to contemplate.

As might have been foreseen by any experienced politician, the taxpayers and consumers were mulcted without even having the consolation of seeing their departed funds recovered by taxation to prosecute the War. During the first fiscal year under price-fixing (July 1917-July 1918) the tax-rate on excess-profits was placed by Congress at less than half the 80% figure then enforced by England. As an example of the pap provided at public expense for scores of pampered producers by a wrong policy of price-fixing, I may instance the United States Steel Corporation, whose net profits during this same year were 250 millions, or double the banner year preceding the Great War and only 50 millions less than for 1916, when profiteering was unhampered and there were no taxes at all to pay.

The unwise policy of price-fixing also reacted badly on labor. Trained to seize the main chance by a lifetime of struggle, our trade-union leaders had seen the

[6] M. & S. P., May 17, 1919, p. 660.
[7] M. & S. P., April 26, 1919, p. 564.
[8] 'Money and Its Circulation', by Irving Fisher.

bonanza afforded by the frenzy for labor of the factories supplying the European belligerents, and during 1915 and 1916 had passed from one victory to another. At the end of 1916 they had become so arrogant, by continual success, as openly to menace our national Congress if it dared to reject the Adamson bill, which proposed to increase the wages of train-crews by 25% at the expense of either shareholders or the traveling public.

In 1917 the new policy of price-fixing, with its liberal grants of largess to certain lucky producers, opened up a new series of bonanzas to be exploited by militant trade-unionism, and to ensure continuity of its war operations the Government was forced to establish a War Labor Board with power to arbitrate between capital and labor, and enforce its decrees. Dominated by labor's representative, the radical lawyer F. P. Walsh, this Board adjusted controversies by granting almost anything the unions demanded. In the case of the war profiteer, this simply meant a division of the rich melons between masters and men, but for the public utilities it spelled ruin because their charges for service were fixed by law. The greatest public utilities, the railroads, were leased by the Government soon after the War began in 1917, so their owners were spared the huge losses consequent upon an increase of the average yearly wage of all employees from $890 at the end of 1916 to $1450 at present. This increase of 68% totals over $900,000,000 annually, or as much as the liberal rental paid by the Government to the railroad owners. In spite of the general increase in freight-rates of 25% and the leveling up of passenger fares to three cents per mile, this greater cost of labor and supplies caused a deficit in 1918 of 802 millions, which will fall on the helpless Federal taxpayer.

After this brief review, anyone may see that the causes of the skyrocketing of prices since 1915 have been few and easily dominated under peace conditions, and that we have only ourselves to blame for the consequences if we follow Professor Fisher and submit supinely to a permanent price revolution. As the scarcity of commodities and high wages have caused dearness, therefore to get cheapness again we must simply resume a plentiful production of useful goods and set wages at their former level. This last proposal, I know, will arouse a storm of protests from many humane but superficial economists who form the unwitting claque of professional labor-monopolists like Mr. Gompers and natural-resource monopolists like Judge Gary. The latter recently submitted a list of 'reduced' prices for steel which were 80% above the 10-year pre-war average,[8] extenuating their dearness by the plea of high wages. Yet if we take the actual increase of wages, it represents only 60% of the $22 per ton that Judge Gary expects to absorb from the steel consumer above the 1914 price—one far from unprofitable to his corporation.

But, says Mr. Van Dyck,[9] "Labor will not submit to material reduction in wages . . . and the man who engages to readjust these conditions by decreasing the scale of living is a fool." And Mr. Robbins remarks,[10] "reduction in costs could only be brought about by increased output of workmen or reduction of wages. There is small possibility that organized labor, backed by a newly created public sentiment, will permit conditions to revert to pre-war standards." It is only the uninformed who fancy that "organized labor" speaks with preponderant authority; actually it comprises some three millions, not 10% of the 35,000,000 of our gainful workers. As only a few Americans have studied much political economy, the voters are prone to be misled by any plausible economic fallacy. Yet even the dullest is beginning to wonder how he is benefited by the 30% (average) increase in his weekly pay-envelope[11] when everything he has to eat and wear costs him nearly double what it did in 1915.[12] No! It was not a low-wage scale that made "pre-war standards" unjust for Mr. Robbins' laborers; it was rather the plundering they underwent by various classes of cunning monopolists, who, under legal forms, carried off to their private coffers the lion's share of the social wealth produced by the modern improvements in government and the means of production.

It is clear that war conditions producing scarcity must be completely reversed before the natural interplay of economic forces can be expected to cause much of a drop in the price-index. Yet it was only last month that the formal peace permitted the disbanding of millions of soldiers and their transformation from mere consumers into active producers. Till then, too, ocean commerce was largely occupied with military needs, and the embargo on trade with Central Europe cut from the world's markets a vast population of highly skilled workers. Even now the former immense stream of Russian exports, which long ago ceased to flow, is still stagnant and will remain so until some cure is found for the existing anarchy of that unhappy country. In the United States no relief can be expected from double prices for our chief food-grain until the Government guarantee expires next spring, while a general readjustment of the wage-scale cannot take place until the partnership between our Federal Department of Labor and a selfish trade-unionism is dissolved by the return of the railroads to their private owners at the end of this year. If Professor Fisher had not been so blinded by his pet monetary theory, it is unlikely that, in the face of these facts, he would have been so thoughtless as to assert, as early as April: "Readjustment waits because we keep on waiting for it. We have waited in vain for *over three months* . . . To talk reverently of 1913-14 prices is to speak a dead language today. The buyers of the country, since the Armistice, have made an unexampled attack upon prices through their waiting attitude and yet price recessions have been insignificant."

[8] 'The Public', April 26, 1919, p. 424.

[9] M. & S. P., February 1, 1919, p. 143.

[10] M. & S. P., May 17, 1919, p. 660.

[11] 'The Public', April 19, 1919, p. 412.

[12] 'The Menace of Privilege', by Henry George, Jr.

Considering now the practical monetary proposals of the coin-clipping school, we find Mr. Van Dyck quoting as a favorable argument that the ratio of gold supply to the total national indebtedness of the belligerents has decreased from 1:3 in 1914 to 1:15 at present. Yet the veriest tyro should know that public debts have no necessary relation to the gold supply unless they happen to be in the form of redeemable currency or demand-notes; but both before and during the War the bulk of public debts has existed as bonds, payable only at fixed dates in the future.

When Mr. Van Dyck states, "All these conditions seem to imply that the monetary value of gold must be increased, or gold must take a partner, or both of these things must be brought about. If it is at all possible to make a change in our monetary standards now is the accepted time," he admits the possibility of bimetallism being alone a sufficient remedy for a scarcity of money-metal. This is an important concession, even though he afterward repudiates it in his practical program by inextricably blending the restoration of free silver with coin-clipping. International bimetallism has always been feasible theoretically[13] and now that a decline in the gold supply, relative to currency needs, has rendered it desirable we have luckily also ready to hand the new League of Nations with ample power to put it into successful practice.

As a final irresistible bribe in behalf of their proposals, the coin-clippers offer us a speedy release from our burden of war debt, estimated by Mr. Van Dyck at the end of 1918 for all the belligerent nations as totaling the huge sum of 160 billion dollars, of which some 12% is the share of the United States. It is true that much of the money invested in these war bonds was gained with less work than in normal times, and if the policy of permanent price-inflation had merely to do with the repayment of war-bondholders much could be said for its justice and expediency. Unfortunately, however, a permanent inflation of prices means a general defrauding of creditors by their debtors and such a general social disturbance that no thoughtful economist would advocate it except as a last resort to avoid national repudiation. In the case of the United States, at least, the great war debt can be met readily, in a way to benefit rather than distress society, simply by applying more science to Federal taxation. True it is that in peace-time we must abandon the yield of a war-profits tax, and the income tax is already of sky-scraping height; yet the land-value tax[14] of immense potential yield has never been tried at all by Congress, while the inheritance tax has only been trifled with.

A popular American tradition says "three generations from shirt-sleeves to shirt-sleeves"; and while this has been absurdly discordant with facts for the past half-century, it is still fervently believed by the millions of dupes of a reactionary press. Yet even such may begin to sit up and take notice when they read the recent statement of Professor Fisher, a mouthpiece of conservative Yale, that "of the 150 or more fortunes yielding incomes of $1,000,000 per year or over, four-fifths have been accumulating for two or more generations." Whatever may be said in defence of an economic policy permitting the concentration of social wealth in the hands of a few private citizens to use as they please, the law that allows the free bequest of millions is a ridiculous anachronism in any nation with pretensions to democracy, as Andrew Carnegie opined a decade ago. Our hereditary plutocracy is ever a danger to free institutions[15] and, as it has no obligations for public service like the European aristocracies, it is rapidly becoming effete through the vices inseparable from luxurious idleness. The national health would therefore be vitally stimulated by abolishing our aristocracy, along with our war debt, by a graduated inheritance tax.

In my recent book for Mexican reconstruction,[16] I have suggested an inheritance tax varying from 20% for estates of a million to 80% on the surplus above five millions. As 2% of our population owns 60% of the total wealth[17] and a large share of this 60% is possessed by a few hundred multi-millionaires[18], a sincere application of these graduated rates to American estates would soon make both hereditary plutocracy and war bonds a matter of ancient history.

R. B. Brinsmade.

Ixmiquilpan, Mexico, July 12.

[13] 'International Bimetallism', by R. P. Rothwell.

[14] 'Taxation', by C. B. Fillebrown.

Formulas for Mine Valuation

The Editor:

Sir—There is an optical experiment—Du Maurier wrote a novel round it—proving that we have a blind spot in our eye. And the quite elaborate discussion of valuation formulas which various writers contributed to your columns last year demonstrated the possibility of a callosity in the pineal gland of a mathematician.

There is really no room for any doubt about the correctness of a formula, because they can all be subjected to a simple test that requires hardly any mathematics at all. This is the test:

Given the universal acceptance of this formula in the discount market, can I sell my investment by it at any time during its currency on terms fair to both buyer and seller?

And the only formula that stands up to this test is the one called Morkill's by H. D. Pallister, but which we all know better as Inwood's. The present value of the investment given by the formula proposed by D. B. Morkill in your issue of August 31, 1918, is equally given by the tables of present values of annuities given in pocket-

[15] 'The Metropolis', by Upton Sinclair.

[16] 'El Latifundismo Mexicano'; published by the Department of Fomento, Mexico City.

[17] 'Wealth & Income of the United States', by Willard King.

[18] 'Free America', by Bolton Hall.

books. Kemp's 'Engineer's Year-Book' for 1918 gives them on pages 6 and 7, and there is no question at all involved as to the investment of part of the return at any particular sinking-fund rate. On page 1913 of the same year-book the relative merits of various current formulas are discussed by Henry Louis, who concludes, "It may be said that the only really correct method of calculating annuities, which answers all tests applied to it, is the first one," namely, Inwood's.

I have not Hoover's 'Principles' handy, but am surprised by Mr. Pallister's statement that the tables given by that authority are based on Hoskold. My recollection, perhaps at fault, is that they are the ordinary annuity-table values derivable from Inwood. If not, then Jove has nodded, just as he has nodded when in comparing the cost of development by a vertical or inclined opening he charged the latter with the cost of a long cross-cut "at surface."

The original purchaser under Whitton's formula cannot pass it on so that the next buyer will come in on a 10-%-and-your-money-back basis unless he is prepared to sell on worse terms to himself than these, and the purchaser under Hoskold's formula is always looking round for a chance to sell by Inwood, when he can give a perfectly fair deal and be money in pocket by it.

R. T. Hancock.

Jos, Northern Nigeria, July 10.

The Status of Silver

The Editor:

Sir—A recent issue of 'The Magazine of Wall Street' contains a most excellent article by Senator Pittman of Nevada on the 'Status of Silver'. The author shows an unusual knowledge of a vital subject little understood by the average man of affairs. In this article, however, he states:

"Our Government by promising to buy silver whenever it dropped to one dollar per ounce prevented London from fixing the price below that amount. In other words, it took the control of the silver market away from London."

I must beg leave to differ with the Senator in regard to the control of the silver market being taken away from London. Since the passage of the bill referred to, the *U. S. Government restriction has been the only thing that held silver down as low as a dollar* per ounce. When buyers in China were bidding $1.30 per ounce for silver, we were forced to sell to the British government at $1.01½ per ounce. I am fully cognizant of the facts and circumstances which render it absolutely necessary that we should come to England's rescue and assist her out of her serious difficulties in India by supplying her with silver, but so far as winning the War was concerned it made no difference whether England paid $1 per ounce, $1.25, or $2 per ounce.

As evidence that the control of the silver market has *not* been taken away from London you will note that since U. S. export restrictions have been removed, *the price of silver follows the price of sterling exchange* either upward or downward, and even during the strenuous and unprecedented slump in sterling exchange during the past few weeks the price of silver has dropped accordingly, and the silver market is as sensitive to the sterling exchange market as is a barometer to weather conditions.

Permitting London to dictate to us the price of silver not only operates to the serious disadvantage of the silver producers of this country, but is also a very important factor in Oriental trade and world finance.

The whole question is too far-reaching and too complicated to admit of discussion in this brief communication, but the War has changed world financial conditions, and the United States of America, which before the War was always a debtor nation, now being the greatest creditor nation in the world and possessing the greatest resources of any nation in the world, is in position to, and logically should, determine and control the money policies of the world.

There is a world shortage of silver, and the United States and Mexico produce the bulk of the world's supply.

If silver continues to be bought and sold as a commodity, the law of supply and demand will place the price of silver on a very high level as soon as various countries throughout the world now in urgent need of silver commence buying in earnest after peace treaties are settled and ratified.

If the price of silver should be based upon a ratio to gold in proportion to the present and probable future world supply of both metals, that ratio would probably be found to be about ten ounces of silver to one of gold, or in other words, if gold is worth $20 per ounce, silver would be worth $2 per ounce. Based upon the present world supply and present world production of both gold and silver, the ratio would make the value of silver considerably more than $2 per ounce, but Mexico is not now, and for a number of years has not been, producing her normal or potential output.

Concerning the large purchase of silver which the British government desires to make, the following are the minimum prices which in my judgment the U. S. government should receive for any sale of silver which it makes to them:

$1.25 per ounce for the 1st 25 million ounces
1.50 " " " " 2nd " " "
1.75 " " " " 3rd " " "
2.00 " " " " 4th " " "

and 2.00 per ounce for any additional amount.

The facts and existing conditions of the gold and silver situation, world financial conditions, the balance of trade conditions are conclusive evidence that the above prices are fully justified.

The military war emergency having passed, it is now purely a commercial proposition.

Although during the War circumstances and conditions made it necessary for the United States, as a war emergency, to furnish England with vast quantities of

silver, the effect of turning over this large amount of silver to England will operate in a commercial way after the War, in much the same way as the selling of arms and ammunition by a country to a country with whom they expected to soon be at war would operate in a military way. When India, through the British government, has accumulated large reserves of silver, they can stop buying for a time, and as the production of silver comes along in a steady stream and the majority of silver producers must market their silver at once, notwithstanding the universal shortage of the metal, it could for a time be made to appear that there is a production beyond requirements and with its consequent effect upon depression of price.

The effects of the control of the world's silver market is much more far-reaching than merely the difference in price which American silver producers receive for their silver (although that is an item which should not be overlooked). The London control of the world silver market is interwoven with dominance in Oriental trade, and also interwoven with the question of whether the pound sterling shall continue as in the past to be recognized as the unit of exchange of international commerce throughout the world, or whether it shall be transferred to the U. S. A. dollar, and also with the question of world financial supremacy being permanently transferred to the United States of America.

EDWIN D. WOLFE.

San Francisco, August 5.

Smelting Flue-Dust and Fine Ore

The Editor:

Sir—In 1910 at the Erith works of Fraser & Chalmers, near London, I witnessed some experiments in burning the poorest grade of coal-waste in the form of dust in a Bennington vertical boiler arranged for the purpose. The combustion chamber was surrounded by banks of tubes connecting the top and bottom drums. The vertical burner was placed in the middle of the chamber at the bottom and pointed to the top drum, which was about eight feet above it, so that the flame impinged on the bottom head of the top drum, with the result that the whole of the waste matter in the coal-dust was fused into globules, and fell down in a continuous shower into the receiving hopper at the bottom. No waste-dust or ash passed into the outlet-flue or stack.

Thinking of this matter lately, it occurred to me that it would be worth while for the big smelter companies using the coal-dust method of firing reverberatory furnaces to experiment along similar lines in smelting their flue-dust and fine ore, instead of continuing the present practice of recovering the dust from the dust-chambers and then charging it in mass into the furnace only to be carried back again by the draft into the dust-chambers or out through the stack. I would suggest that one way this could be done would be to feed the flue-dust or fine from a bin through a mechanical feeder, in suitable proportion to the coal, into the coal-pulverizer so that it would be ground with and intimately mixed with the coal-dust and be discharged with it through the ordinary burners into the reverberatory furnace in the usual way. From what I saw at Erith I should expect the flue-dust or fine ore so mixed with the stream of coal-dust to be immediately fused into globules as it left the burners and in the first few feet of its travel through the flames in the furnace. Surely there would be no chance for it to be carried out of the furnace in the form of dust.

Another way would be to place the flue-dust bin and feeder over the furnace and make a new style of burner on the injector principle, so arranged that the inrush of the coal-dust through the nozzle would carry the right proportion of flue-dust or fine ore with it. But I should not expect this plan to work as well as the first one proposed.

W. M. BARKER.

McGill, Nevada, July 31.

MINES IN NEW MEXICO during 1918 produced $681,000 in gold, 782,000 oz. of silver, 8,235,000 lb. of lead, 98,300,000 lb. of copper, and 24,100,000 lb. of zinc, according to the U. S. Geological Survey. The statistics for 1919 will show a considerable decrease in the output of all metals except gold. The Chino Copper Co., which in 1918 produced 79,340,372 lb. of copper and $39,732 in gold and silver, produced only 11,512,133 lb. of copper during the first quarter of 1919, owing to curtailment of operations. This company hopes to be able to continue operations at 50% capacity. The Burro Mountain Branch of the Phelps Dodge Co., which in 1918 produced 53,146 tons of concentrate averaging 14.9% copper, was so seriously affected by the drop in the price of copper that it has suspended operations. The Santa Fe Gold & Copper Co. has also ceased operations at San Pedro. During the first five months of 1919 the 85 Mining Co., at Lordsburg, shipped a quantity of silicious copper-silver-gold ore almost equal to that shipped by it during the entire year 1918. Development at Mogollon may maintain an output of silver equal to that of 1918, when the Fanney mill was operated only 5 months. The combined gold districts of Nogal, Whiteoaks, and Baldy have so far produced ore at an increased rate. The decreased shipments of lead and lead-zinc ores from Magdalena and the discontinuance of the shipments of lead from the Organ Mountains district will greatly reduce the output of lead from the State. The suspension of operations at Pinos Altos and the curtailment of operations at Hanover and Kelly will naturally result in a greatly decreased output of zinc.

MINES IN WYOMING produced 7 ounces of gold, 253 oz. of silver, and 754,324 lb. of copper in 1918. The shipments of silver-copper ore from the Sunrise mine, near Hartville, the principal producing mine in Wyoming for several years, have not been continuous in 1919. A mill has been built to treat the dump ores of the old Ferris-Haggerty mines (long idle) at Encampment. The Rambler copper-platinum mine at Holmes has been idle in 1919.

Relation of Regional Deformations to the Distribution of Ore in the Pre-Cambrian

By ELLSWORTH Y. DOUGHERTY

INTRODUCTION. The unusual promise afforded by the pre-Cambrian shield of North America to the seeker of valuable minerals is appreciated by all who have studied this remarkable area of ancient rocks. Formations similar to those that furnish the iron and copper of the Lake Superior region, the nickel-copper of Sudbury, the silver of Cobalt, and the gold of Porcupine occur over a vast expanse of still imperfectly explored country. The efforts of geologists in various districts of the pre-Cambrian area are resulting in important correlations of igneous activity with ore deposition. It is being shown, for instance, that gold deposits like those of Porcupine and Kirkland Lake and other parts of Ontario, and in Manitoba, are genetically connected with the wide-spread so-called Algoman granites. Silver, cobalt, nickel, and arsenic in Cobalt and outlying areas, nickel-copper at Sudbury, native copper in Michigan and in the Coppermine River country are all considered as genetic relatives of basic intrusives and extrusives of Keweenawan age.[1]

The hypothesis that ore deposits of the hydrothermal and igneous types can be referred to igneous activity of well-marked epochs is perhaps the most useful generalization yet contributed by students of metalliferous deposits. Since igneous activity and regional dynamic disturbances are so commonly related, and since the history of ore deposition is frequently linked with igneous activity, it follows that the deposition of ore should favor areas of regional dynamic disturbance. The interpretation and application of this general principle to some districts of the pre-Cambrian shield, is the purpose of this article.

STRUCTURAL FEATURES. In many districts, geological maps show the pre-Cambrian terrains dominantly developed in elongated series, due to pressure and folding followed by erosion.[2] A striking structural feature is the wide-spread general parallelism of the axes of folds. Younger folding is frequently superimposed parallel to folding of a vastly older period. The greater number of the axes of folds strike in two general directions—east-northeast octant or north-northwest. These conditions point to compressive forces of wide regional effect, recurrently active in the same general directions.

SUDBURY. In the Sudbury area the nickel-copper deposits are adjacent to the basic periphery of an elongated micropegmatite-norite intrusive. The norite intrusive has a major axis trending east-northeast, parallel to the general elongation of the intruded underlying rocks. This elongation of the older rocks was originally developed by regional deformation far antedating the time of norite intrusion. The form of the norite itself seems due in part to its major development parallel to the principal directions of weakness of the intruded rocks and in part to later deformation affecting norite and intruded rocks together and accentuating the old directions of elongation and of weakness. As Coleman writes: "One must think of the underlying country-rock as having been broken and shattered in many places by collapse during the removal of the molten rock from beneath, and also by the mechanical action of the laccolithic sheet spreading out above."[3] Such a collapse must have produced lateral pressure upon the borders of the sagging mass, with attendent deformation. The cooling magma itself was under great pressure, as pointed out by Dresser[4] and others. Gravitative or other modes of segregation were greatly modified by the action of stresses upon the norite and intruded rocks. For instance, 'offset deposits' were formed along deep-seated zones of weakness. The occurrence of the deposits along lines of crushing, brecciation, and shearing has been emphasized especially by Knight.[5] A noteworthy fact is that such zones of disturbance were mainly developed in the principal directions of weakness of the pre-Cambrian shield as a whole (east-northeast and north-northwest) conceivably linking the Sudbury dynamic phenomena with the major and repeatedly active deformations of pre-Cambrian time. Just as the Sudbury norite is probably the correlative of other large basic intrusives, widely distributed over the pre-Cambrian area, so it is possible that the dynamic effects accompanying and succeeding the norite intrusion are intensified and localized manifestations of Keweenawan deformations of far wider extent.

COBALT, PORCUPINE, AND KIRKLAND LAKE. These districts furnish some interesting and instructive examples of the interrelation of the distribution and localization of hydrothermal ores with stresses of regional development and significance. In these areas it appears that:

1. The loci of ore deposition are sheared surfaces,

[1]'Metallogenetic Epochs in the Pre-Cambrian of Ontario', W. G. Miller and C. W. Knight, Report Ontario Bureau of Mines, pp. 243-245, 1915.

[2]Compare maps of the Lake Superior region, of the Rainy River district, of the Sudbury area, of Porcupine and Kirkland Lake, and of numerous other areas.

[3]'The Nickel Industry', Canadian Department of Mines, pp. 35-36, 1913.

[4]Myron A. Dresser, 'Some Quantitative Measurements of the Nickel-Eruptive at Sudbury', 'Econ. Geol.', Vol. XII, No. 7, pp. 563-580, 1917.

[5]C. W. Knight, 'Report of the Royal Ontario Nickel Commission', 1917.

joints, folds, and other structures produced by compressive earth forces.

2. The zones of maximum deformation, and therefore of maximum ore deposition, are distributed along certain belts determined by the larger structural zones of weakness.

3. The distribution and configuration of intrusive igneous rocks, conceivably related genetically with the hydrothermal ores, may also be controlled, particularly in regions of pronounced dynamically metamorphosed rocks, by major zones of regional disturbance.

In a former article[6] I sought to show that the lode-fissures of Porcupine could be explained as due to shearing stresses developed by tangential earth-thrust. In this district, two undoubted results of this movement are seen in the development of schistosity and thrust-faulting, respectively of pre-mineral and post-mineral ages. The inference is strong that the shear-zones, along which the ore was deposited, are manifestations of an intermediate type of deformation, also produced by compressive forces. The wide-spread occurrence of the lodes, cutting numerous types of rocks, and the frequent agreement of the attitudes of the lodes and their component parts, with probable horizontal axes of compression, indicate some widely acting influence such as a compressive earth-movement would provide. The foliated rocks are sometimes contorted, as if by a buckling compressive force; this locus of contortion is not infrequently the place of ore deposition.

In the Kirkland Lake area, the orebodies occur along well-developed smooth planes of dislocation, of dominant east-northeast strike. This is also the principal direction in which the rocks are elongated. Pronounced compression is indicated by the decided squeezing and shearing of the country-rocks along the orebodies. These features and the widespread general parallelism in strike of the lode-fissures to one another and to the main direction of weakness in the district, suggest the origin of the lode-fissures by compressive forces.

The results of geological investigation of the Cobalt district, by A. R. Whitman, indicate that the distribution of the veins has been controlled in part by the folding of the rocks. As shown by a formational contour map, the joints and fractures, along which the ores lies, bear a consistent relation to minor anticlines and synclines developed in conjunction with the major folding of the rocks of the district.[7]

The more productive mines of the Porcupine area lie along parallel belts of east-northeast trends. The schistose rock terrains are characteristically elongated in the same direction. This direction of elongation marks the trend of the axes of major folds, in which strikes of east to north-east predimonate. The axes of these folds are now difficult to trace, on account of the extreme constriction of the rocks. However, mapping suggests strongly that the Dome lode-system lies along a major syncline.[8] Similarly, some general relation undoubtedly exists between the distribution of the Hollinger-McIntyre lode-system and major synclinal or anticlinal axes. As would be expected from the interplay of compressive forces, the lodes follow zones of shearing and fracturing with variable strikes and dips, but a large number of the lodes strike in the east-northeast octant. In other words, in agreement with conditions at Kirkland Lake, the horizontal component of dominant differential movement had a wide-spread development parallel to the major direction of weakness in the district (east-northeast in both instances), which is a wide-spread direction of weakness for the pre-Cambrian shield as a whole. In general, the more highly sheared rocks at Porcupine are also zones of maximum ore deposition, as is illustrated by the unusually productive zones of the Hollinger, McIntyre, and Dome mines.

The Kirkland Lake area is an unusually clear example of the occurrence of maximum fissuring and ore deposition along a larger structural locus of weakness. The principal structural feature of the district is a fissured zone of metamorphosed sedimentaries and intruding dikes and stocks; this belt trends mainly east-northeast, and is flanked north and south by older Keewatin greenstones.[9] The relations suggest strongly a major syncline. The more productive mines lie along this synclinal belt.

The maps and sections of the Cobalt district[10] show plainly that proximity to the folded sill of diabase, with which the silver ores are presumed to be genetically connected, does not alone control the distribution of the ores. The most productive area is in the vicinity of the Cobalt Lake syncline and fault. These structures mark a major zone of disturbance; it would appear that this feature, as well as the occurrence in large volume of the favorably fracturable conglomerate and other fragmental rocks, are dominant factors in promoting maximum ore deposition.

In the Porcupine and Kirkland Lake areas, dikes and stocks of hypabyssal[11] intrusives are commonly closely related spacially to the ore-zones. At Porcupine, a schistose quartz-porphyry occurs in considerable volume in the more productive Hollinger, McIntyre, and Dome mines; at Kirkland Lake, feldspar-porphyry and lamprophyre are aggregated to an unusual degree along the synclinal belt already mentioned. In the latter instance it is evident that a major zone of regional disturbance has provided an avenue for dominant hypabyssal injection At Porcupine, the schistose quartz-porphyry masses tend to occur in belts and are typically elongated parallel to the general elongation of the rocks they intrude. From this relation and the not infrequent parallel disposition of small apophyses of quartz-porphyry along planes of foliation of the intruded rocks, it appears that the

[6]"The Gold-Quartz Lodes of Porcupine, Ontario", M. & S. P., April 19, 1919.

[7]Personal communication to the writer.

[8]See maps accompanying 24th Annual Report of the Ontario Bureau of Mines.

[9]See map accompanying Report of Ontario Bureau of Mines, Part 2, 1914.

[10]Report of Ontario Bureau of Mines, 1913.

[11]Intermediate between deep-seated and superficial.—Editor.

elongation of the quartz-porphyry bodies was due, at least in part, to their tendency toward major development in the direction of weakness of the intruded rocks, and hence of the district as a whole.

At both Porcupine and Kirkland Lake, therefore, it is probable that the association of intrusives and ore deposits along recognized belts are expressions of related phenomena, structurally and genetically. In both cases the intrusives are themselves cut by the ore-lodes. It seems clear that major zones of weakness had been established at the time of igneous intrusion and that regional structures determined in large part both the distribution and configuration of the intrusives. Intrusion itself might, under certain conditions, accentuate this weakness, and through the introduction of a rock of a character different from that of the intruded rocks, an increase in the capacity for differential yielding under pressure would be imparted to that particular locus of the earth's crust. It is logical to suppose that these cumulative intrusive and dynamic effects would afford the most favorable avenues for metalliferous circulation. The recurrence of igneous activity along certain well-marked segments of the earth's crust is one of the truisms of geology. It may be justifiably assumed, therefore, that the very presence of the intrusives is significant of the manifestation of particularly favorable zones for the ascending products of igneous mechanism; these in the first instance were in the nature of rock material and in the second of volatile metalliferous products, tending to follow the old established paths. Such reasoning would apply, even in the event of a decided interval of time between the solidification of the intrusive rock and the ore deposition; as at Porcupine, where the quartz-porphyry was rendered schistose before ore was deposited within it.

PRACTICAL APPLICATIONS. The realization of the control of rock-structures developed by earth-stresses upon the distribution and localization of hydrothermal ore deposits of the pre-Cambrian shield admits of wide application. The prospector in Northern Ontario knows from experience that gold deposits occur in belts and that it is wise to trace continuations of ore-zones in the direction of the longer axes of the rocks. In the pre-Cambrian shield of North America dominant directions of weakness are persistently shown by axes of folds, faults, and elongated rock-masses, and by the streams and lakes that commonly delineate these weaknesses.[12] In large part, these directions of weakness fall within the north-north-

PRE-CAMBRIAN REGIONS OF NORTH AMERICA

[12]Most investigators of the pre-Cambrian shield, fully appreciate these points. For instance, W. G. Miller described and figured northwest-southeast and northeast-southwest lines of regional disturbance in eastern Ontario, and early suggested some connection of the latter system with the distribution of silver-cobalt ores. Report Ontario Bureau of Mines, pp. 116-119, 1913; also earlier editions.

west and east-northeast octants; the latter is commonly the better developed and more wide-spread; the former may sometimes be the more pronounced, is usually more localized, and probably always traceable. A main structural direction of weakness along belts of disturbed rocks associated with intrusives merits careful prospecting.

Mine operators are usually more concerned with the localization of ore than with its general distribution. The lessons shown by the general dynamic history of the pre-Cambrian shield are important; just as the larger results of regional stress control the general distribution of the deposits, so the minor deformations control their localization. In general, the following suggestions may frequently be applied:

(1) As a working hypothesis, it may be supposed that the orebodies are localized in zones of maximum differential movement, such as the more schistose, sheared, fractured, folded, or jointed rocks. When it is found that one or more of these structures dominantly control the localization of the ore, indications of similar conditions will invite exploration.

(2) Usually one or more types of rocks will show a superior development of fissuring, folding, or other deformative effects, resulting in maximum ore-concentration in the favorably disturbed rocks.

(3) Contact-zones between physically heterogeneous rocks may be favorable loci for differential yielding and hence for ore deposition.

(4) Strikes of the orebodies are likely to bear a consistent relation to the structures of the rocks; this should prove a decided aid in planning cross-cuts.

(5) For any particular locality, one may suspect a certain consistency in the direction of principal axes of stress; recurrent compressive effects, in the same general directions, are likely to occur; their variable superimposed results may be suspected and sought.

These conceptions have been found useful by me in helping to understand something of the causes of ore-localization and the nature of thrust-faulting in the Porcupine district.

THE State of Kentucky is the happy hunting ground of the oil prospector of small means, yet the outcome of his endeavors does not always make him happy. The percentage of unsuccessful tests in the State is somewhat high—about 19%—compared with the average for the country as a whole, which is about 16%, but the oil is found at relatively shallow depths, commonly 300 to 1000 ft., and the cost of drilling wells is low. The rock outcrops in the State are plentiful, and the areas where the geologic conditions are most favorable to the occurrence of oil can be found easily. The most productive group of oilfields in Kentucky is in the vicinity of Irvine, Estill county, and is described in Bulletin 661 D of the U. S. Geological Survey, published in 1916. The second richest group lies in and around Allen county, more than a hundred miles south-west of Irvine. The fields in Allen county are the subject of a report by E. W. Shaw and K. F. Mather just issued by the Geological Survey as Bulletin 688, and available on request from the Director. A barrel of oil obtained in Allen county was sold in Bowling Green in 1850, but oil in Kentucky has only recently become a product of great commercial value, the production of 1918 having been ten times as great as in 1915. The oil in Allen county is irregularly scattered through the productive area, and a great many of the wells have therefore been failures, but on the whole the county appears to be about as rich in oil as any other county in the State except Estill and Lee.

Tungsten in Portugal

Tungsten generally is called wolfram in Portugal, and is sold by the mines as tungsten tri-oxide, WO_3, on the basis of its richness in tungstic acid. The production has been from 900 to 1500 tons per year, as nearly as can be ascertained. The ore is usually found in small veins embedded in quartz. There is considerable placer ore, which, during the wartime high prices, was the source of a good revenue to the bands of thieves that operated through the mining district despite special watchmen and Government police. The usual wolfram averages from 55 to 65% tungstic acid, and in some mines, by careful washing, from 70 to 72% has been obtained. Tungsten is found in the central and northern Provinces of Minho, Douro, Traz-os-Montes, Beira Alta, and Beira Baixa, as wolframites, including ferberite iron tungstate, hübnerite, manganese tungstate, wolframite iron manganese tungstate, and scheelite (in very small quantities). Before the War, the cost of production was approximately 300 to 450 escudos ($300 to $450) per ton. Increased demand, higher salaries and wages, taxes, and transport charges resulted in an immediate advance in cost to 800 and 1500 escudos per ton. The value of the escudo dropped to 70c., and even lower. The selling price was established by the Government during the War on the following basis: Mineral with 60% WO_3, 100 francs at the export station; over 60%, 3 francs more per each unit up to 65%, which means that ore with 65% WO_3 was paid 115 francs; over 65%, 2 francs more per each unit up to 70%, which means that ore with 70% was paid 125 francs; over 70%, 3 francs more per unit. There is no use for tungsten in the country and no importation of ferro-tungsten. It is stated that some local concerns are planning to use the metal, but as yet there have been no actual developments along this line. The end of the War paralyzed the industry and the Government thus far has taken no action. Mine owners have protested against the law of 1917, which imposes a tax of about 180 escudos (nearly $150) per ton in addition to a similar sum as an export duty. It is stated that during the War German agents paid as high as 115 shillings for a unit of 60% ore. A new law which will be presented to the Government will remove many obstacles that impede the development of this industry, which at one time was a valuable assistant to the Allies. The mines are owned by an American company.

Conventional Symbols for Mine Maps

By LESTER C. UREN

There has been a strong tendency in recent years to standardize everything from mine accounts to the phraseology used in technical writing, but there seems to be a singular lack of interest in every effort to standardize the symbols used on mine maps. On several occasions the topic has been discussed in the technical press and elsewhere, but we have, as yet, no conventional symbols for use on mine maps that might be fairly regarded as having received the stamp of general approval. Only a few of the many symbols that are in use have approached standardization through common usage; and yet there seems to be a real need for agreement on at least the more frequently used symbols. Just as one must be familiar with the phraseology of a technical article in order to gain a full understanding of it, so he must be familiar with the symbols used on a mine map if he is to interpret it properly.

It makes little difference, perhaps, whether we use a full or a half-shaded rectangle, or one with crossed diagonals, to indicate a passage extending upward from a level in order to distinguish it from one extending downward, but if engineers use such symbols undiscriminatingly and without mutual understanding, much confusion may result. Such symbols are seldom explained in the legend that accompanies the map, and it is generally necessary for the reader to decipher for himself the code that the draftsman makes use of, often at the expense of considerable time and study.

Map draftsmen accustomed to the usage of a group of symbols at some particular property, or among a certain coteric of engineers, have the idea that such symbols have become standard, only to find when transferred to a new organization or locality that their use of these symbols is questioned or misunderstood. An inspection of mine maps, representing the best practice in many widely scattered Western metal-mining districts, shows conclusively that there are no accepted conventions and that no real standards can be said to have been developed.

Much more has been accomplished in other fields of drafting practice than in mine-mapping, in the development of standard conventions. Mechanical draftsmen have a commonly accepted code of symbols that has come into such general use that it is truly a 'sign language'. Architectural and structural draftsmen, too, have developed a fairly well recognized set of conventional symbols.

The accompanying four plates present a series of conventional symbols that are used by engineering students in mine-mapping at the University of California. They have been gathered from various sources,* and they represent, as nearly as I am able to determine, the nearest approach to a group of standards afforded by a close study of current mine-mapping practice. There are a few repetitions of symbols, since each plate is intended to apply to particular classes of work and be complete in itself. Thus, Plates 1 and 2 contain symbols for use on surface or topographic maps, while those on Plate 3 are useful particularly on maps of underground workings. The symbols suggested on Plate 4 may be used on topographic maps to show areal geology, or they may be applied to geologic maps and sections.

Since these pages are printed in black, it is not possible to reproduce the symbols in the variety of colors in which they would be applied to the map. However, it will be noted that the descriptive lettering on the plates specifies the colors to be used, either for each symbol or for each group of symbols. When no color is mentioned, it is intended that black will be the color used.

Some instructions other than those it has been found possible to give on the plates will assist in the application of these symbols to the best advantage. These will be suggested briefly under the following headings, which coincide with the plate numbers on which the particular symbols discussed are to be found.

PLATE 1. In drawing contours, the heavy contours should come at 100-ft. intervals. If the contour interval is small, however, the accented 100-ft. contours may be too far apart for ready reference, in which case any convenient multiple of five may be used as the interval between heavy contours. The numbers indicating elevations of contours should be lettered in the contour—not above or below it—in a space left for the purpose, and they should always read up-hill. While brown is the color suggested for contours, if tracing cloth and India ink are the media used, it is preferable to use a mixture of equal parts of yellow and brown ink.

*U. S. Geological Survey, printed folio-sheets illustrating topographic map-symbols used on U. S. G. S. maps, edition of May 1907.

U. S. Bureau of Mines Tech. Paper No. 22, 'Electrical Symbols for Mine Maps', by H. H. Clark.

Canadian Copper Co. (now International Nickel Co. of Canada), drawing-office standards.

'Topographical Drawing and Sketching', by H. A. Reed. John Wiley & Sons, 1912.

'Topographical Drawing', by E. R. Stuart. McGraw-Hill Book Co., 1917.

'Standard Map Conventions', by A. G. Wolf. Engineering & Mining Journal, July 28, 1917.

'Some Symbols Used in Mine Mapping', by W. J. Crocker. Mining & Engineering World, Nov. 29, 1913.

'Plane Surveying', by J. C. Tracy. John Wiley & Sons, 1908.

Conventions Used on Topographic Maps.

HYPSOGRAPHY
(Color Brown)

- Contours. (Every fifth contour accented)
- Dumps and steep slopes
- Dump and car track.
- Fills
- Fill (shown by contours)
- Open Cuts
- Cut (shown by contours)
- Stripping
- Open Pits and Depression Contours.
- Sand and sand dunes

BOUNDARIES, CORNERS AND POINTS.

- Property Lines and Corners (Color: black. A narrow band of color accents the inner side of the perimeter of each property.)
- U.S. Mineral Monuments
- Triangulation Stations and Primary Traverse Monuments.
- BM X 1420 — Bench Marks (Color: Brown)
- Red — Temporary Transit Stations
- Permanent Transit Stations
- Section and Township Lines and Corner.
- Boundary Lines and Monuments
- Lode Lines and Posts

HYDROGRAPHY
(Color: Blue)

- Streams: Large Size; Medium Size; Small Size; Intermittent
- Lakes or Ponds
- Intermittent Lakes
- Reservoir and Dam.
- Pipe-line
- Flume
- Ditch
- Water Tank
- Marsh along shore-line of stream or lake.

GEOLOGICAL SYMBOLS
(Color: yellow)*

- Granite / Slate / Gneiss / Diabase — Contacts (free-hand): Accurately determined; Not accurately determined
- N. 40° E. / 60° — Strike and Dip
- Fault
- 40° / 70° — Shear Zone
- Vein or Dike

Arrows indicate direction of dip of contact, fault-plane or vein.

*Note: If conventional symbols or colors are applied to areas covered by different rocks, black ink may be used. Names of rocks at contacts may then be omitted.

PLATE 1

Conventions Used on Topographic Maps.

ARTIFICIAL FEATURES AND STRUCTURES
(Color: Black except as otherwise noted)

- To Eureka — Wagon Road
- Little used or Abandoned Road
- Trail or Path
- Railroads: Large scale, Std. Gauge; Narrow Gauge; Medium scale, Std. Gauge; Double-track, medium scale; Narrow Gauge, Electric; Std. Gauge El., Medium Scale; Std. Gauge El., Large Scale
- Power Line
- Fence
- Telephone Line
- Aërial Tramway
- Bridge
- Railroad Bridge
- Ferry
- Ford
- Dams
- Trestle
- Hoist — Buildings: Large scale; Small scale
- Hospital
- red — Powder Magazine
- Water Pipe (Color: Blue)
- Valve — Air Pipe (Color: Green)
- Steam Pipe (Color: Yellow)
- Manhole — Gas Pipe (Color: Orange)
- Sewer (Color: Gray)
- Oil Pipe (Color: Brown)

MINE OPENINGS

- A / B — Shafts: Rectangular; Circular
- Tunnels (Dotted lines show direction and length)

A = Large Scale, B = Small Scale

- 40° / 310' — Diamond Drill Hole (Color: black circle and arrow, red center) (Arrow appears only on inclined holes and points in direction of dip)
- Churn Drill Prospect Hole (Color: Black circle, orange center)
- Black Circle with: Water well — Blue center; Oil well — Brown center; Gas well — Green center; Sulphur well — Yellow center; Barren well. — Solid Black
- Mines and Quarries — Used only on small scale maps
- Prospects

REFERENCE POINTS AND LINES

Coordinate System in light-weight carmine lines. Use black ink for border lines and coordinate figures.

Scale 1/125,000 — 0 1 2 3 4 5 Miles

100 0 100 200 300 400 500 Ft

Scale 1 inch equals 200 feet.

Scale Lines

Meridians should be proportioned to conform with size of map

PLATE 2

Conventions Used on Mine Maps.

SHAFTS, RAISES AND WINZES

- Collar of three compartment timbered shaft.
- Collar of untimbered shaft.
- Abandoned Shaft.

(Surface Intersections)

- Opening Downward
- Opening Upward
- Opening both up- and downward

(Intersection of shaft, raise or winze with horizontal opening.)

- Circular shafts or test-pits.
- Ore-chute

LEVELS, ADITS, DRIFTS, TUNNELS AND CROSSCUTS

(In Plans)

- Levels, drifts or adits in ore-body (various colors)
- Cross-cuts, levels or adits in "country rock."
- Tunnel and Portal.

(In sections)

- Intersecting drift or cross-cut extending away from plane of projection
- Ditto, toward plane of projection

SHAFT STATIONS

- Shaft and shaft station in transverse section with ore-pocket
- Two-compartment inclined shaft and shaft-station, at intersection with drift, shown in plan.

STOPES, ROOMS AND PILLARS

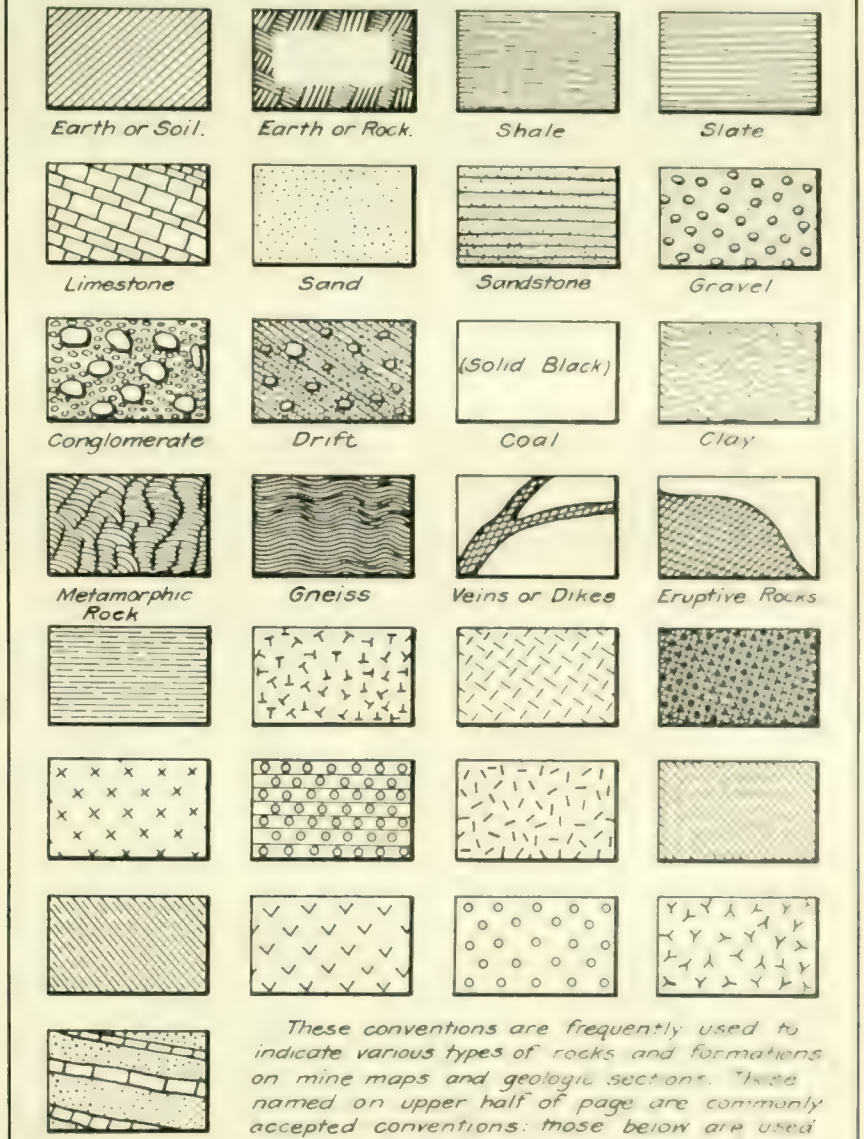
- Shrinkage stope with two chutes above drift: Stopes hachured in both plans and projections
- Room and haulage level in bedded deposit.
- First-Aid Station.
- Explosives Room.
- Natural Pillar left to support "roof."

MISCELLANEOUS

- Sump.
- Concrete Brattice: A = With Manhole; B = Solid.
- Timber Door.
- Temporary Transit Station (red)
- Permanent Transit Station (red)
- Bench-mark (Brown)
- Water Pipe (Blue).
- Air Pipe (Green).
- Telephone (Orange).
- Power Line (Brown).
- Electric Light (Violet).
- Motor, Fan, Pump, Hoist, Gong — Symbol to be in green if operated by air, in brown if electrically driven.

PLATE 3

Geological Conventions.



These conventions are frequently used to indicate various types of rocks and formations on mine maps and geologic sections. Those named on upper half of page are commonly accepted conventions: those below are used occasionally to designate any type of rock

PLATE 4

Colors used to accent property lines are preferably applied as a wash, and the tints used should be delicate in tone. The width of this band of color, to give the best appearance, will vary with the scale of the map and the size of the area to be enclosed. For a group of full-sized mining claims plotted on a scale of 500 ft. to the inch, a 1/10-inch band of color looks well. If the same map is plotted on a scale of 100 ft. to the inch, however, a wider band—say, ½ inch—will be preferable.

Small triangles, circles, and squares used to indicate triangulation stations, survey stations, monuments, reference points, etc., should be small, ranging between 1/20 and 1/10 inch in their largest dimensions. The best size to use will again depend upon the scale of the map, the latter dimension suggested being appropriate only for maps constructed on a scale of 50 ft. per inch or larger.

Blue stream lines used to characterize watercourses and submerged areas, should be purposely waved, as smooth lines used for this purpose seldom appear well. They should be very fine lines to give the best appearance. The shore-lines should be quite heavy and the nearest adjacent stream-line placed as closely as possible to it, leaving only a narrow white space between. In the case of a watercourse, a small arrow may be added to indicate the direction of flow. This arrow may be placed in the centre of the stream if space between banks permits; if not, it may be placed near either bank.

Plate 2. Parallel lines representing railroads are spaced at gauge-width, according to scale, on large-scale maps. On small-scale maps, one of the single-line symbols should be used. For temporary tracks, dotted symbols similar in form to those suggested for permanent installations, may be employed.

The symbols used to represent buildings on large-scale maps are improved somewhat in appearance by shading the lower and right-hand edges, as though the source of light were in the direction of the upper left-hand corner of the map and the buildings cast shadows represented by heavier lines. On more elaborate maps, the areas enclosed to represent buildings may be tinted, and a color scheme adopted to indicate the material of which the building is made. Thus, red may indicate a brick building; sepia, one made of wood; gray, iron or steel; blue, concrete; green, stone.

Co-ordinate lines should be made as fine as possible. To facilitate reference, numbers marking their distance from the origin of co-ordinates should be placed at each end of every co-ordinate line, just within the border-line. On tracings, the co-ordinate lines are sometimes placed on the back of the sheet so that they will appear in their proper relation as a convenient convention for reference purposes, rather than as an integral part of the map. This is also done so that erasures may be made on the map without marring the co-ordinate lines. The co-ordinate lines should not be spaced at less than 2-in. intervals; that is, 100 ft. apart on a scale of 50 ft. to the inch, or 200 ft. apart on a 100-ft. scale, etc. On maps plotted to a larger scale than 50 ft. to the inch, the co-ordinate lines should not be spaced at smaller intervals than 100 feet.

The purpose of a scale-line is to provide a means of scaling distances on the map with the dividers. It also preserves the original scale for reference purposes in case the paper on which the map is made should expand or shrink. A scale-line is particularly necessary if the map is to be later reduced or enlarged by photographic methods.

The meridian arrow, used to indicate the North point on the map, should coincide with one of the co-ordinate lines. The length of the arrow should be proportioned to conform with the size of the map; thus, for a map 27 in. by 40 in., an arrow 6 in. long is suitable, while for an 8½ by 11-in. page, a 2½-in. or 3-in. arrow is long enough. The magnetic declination for the particular locality and for the time at which the survey was made, may be lettered along the stem of the arrow, or, perhaps, indicated graphically by means of a second arrow, marked 'magnetic meridian', through the centre of the arrow pointing the true North.

Plate 3. Where one level crosses over another, in a composite plan showing several levels of a mine, the lower level will always be dotted. The tints to be applied to the various levels, on both plans and vertical projections, will be carefully selected to give as much contrast as possible between adjacent levels. Thus, blue will never be placed next to purple, nor orange next to red. Should two levels cross each other several times at acute angles in the plan view, there will then be no confusion in following either level beyond the intersections. For convenience in reference, a definite color-scheme may be adopted for coloring the levels, using five or ten colors that are repeated at regular intervals. Thus, if five colors are used, level No. 1 may be tinted red; level No. 2, blue; level No. 3, yellow; level No. 4, purple; level No. 5, green; level No. 6, red; and so on, repeating the same colors in the same sequence for levels 7, 8, 9, and lower levels. Then, as frequently happens, if levels are spaced apart, in elevation, at regular intervals, the space between levels of the same color will always be a constant quantity; a convention useful for many purposes.

Cross-cuts, levels, or adits not in vein-material, or within the orebody proper, are divided into uniform rectangular areas by means of lines cutting across the level at regular intervals. Alternate rectangles, thus formed, are tinted with the same colors as are used on the main drifts with which they connect.

Cross-hatching shown on stoped areas, either in plan or vertical projection, should be of the same color as the tint used on the level below. Another plan frequently practised is to cross-hatch stoped areas in black and also apply water-color or crayon to the entire stoped area to match that used on the level below.

In some cases, on mine maps, it is necessary to indicate progress of operations. In plans and vertical projections of mine openings, the boundaries of excavations are indicated either by solid or dotted lines, and the dates of such boundaries may be printed along them at

intervals. Different colors or conventional hachuring may also be used to indicate areas stoped or lengths of drifts driven during specified periods.

PLATE 4. Methods of indicating different formations and varieties of rocks on geologic maps and sections, involve either the use of symbols of characteristic pattern, or color-washes applied to the different areas according to some conventional color scheme. Plate 4 suggests a group of symbols for a one-color map, such as one made on tracing-cloth for blue-printing, brown or black-process printing, or for photographic reproduction. Freehand symbols are generally preferable to those mechanically formed, though careful spacing and alignment of symbols is usually necessary to produce a satisfactory result.

If colors are used, the pen symbols are, of course, unnecessary. Color conventions for geologic maps possess the great advantage that they do not mask other features of the map, such as topographic details, that are often as important as the geologic data. Color-washes should be applied as lightly as possible, since the effect is more pleasing than if harsh tones are used. If the tint is too light, a second coat may be applied when the first is thoroughly dry. Small areas generally require a somewhat heavier tint than do large areas. An effort should be made to select a color scheme that will contrast adjacent tinted areas, though this is not always possible on account of the vagaries of rock formations.

Maps intended for the use of people not continually in contact with them, or unfamiliar with the symbols used, should be accompanied by a suitable explanatory legend. An alternative plan, that indicated on Plate 1, consists in lettering the names of the rocks at intervals along all contacts. An abbreviation of the rock name is often sufficient, thus: gr. for granite, ss. for sandstone. The U. S. Geological Survey makes use of all three of the methods suggested for indicating different rocks on its geologic maps and adds a complete legend as well.

MANGANESE ALLOYS imported and made in the United States during 1918 derived 35% of their metallic manganese from ore mined in the United States. As the proportion of domestic manganese in such alloys was only 4% in 1913 and 16% in 1916, the domestic miners of manganese made a notable contribution to the nation's independence in mineral supplies in war-time. Had the War continued for another year, domestic ores would probably have supplied half the manganese in the manganese alloys needed by the country.

CHILE COPPER CO., for the quarter ended March 31, 1919, reports a deficit of $660,769. In the preceding quarter, the surplus amounted to $300,936, or eight cents per share (par value $25) earned on $95,000,000 capital stock. On account of the condition of the copper market operations were curtailed to approximately a 50% basis. Production of copper for the quarter averaged 5,169,641 lb. per month compared with 9,768,505 lb. per month during the last quarter of 1918.

Mining in Colorado in 1918 and 1919

During the year 1918, mines in Colorado produced $12,705,000 in gold, 6,900,000 oz. of silver, 66,000,000 lb. of lead, 6,190,000 lb. of copper, and 86,550,000 lb. of zinc, according to statistics compiled by the U. S. Geological Survey. The statistics for 1919 will show a considerable decrease in the output of all metals in the State. The production of gold alone will decrease at least $2,000,000. If production is continued at the rate maintained for the first five months of 1919 the mines of Cripple Creek, which produced $8,125,000 in 1918, will produce $1,500,000 less in 1919. The Telluride district, which for several years has been the most persistent producing district in Colorado, will probably not equal its output of 1918, for the prevalence of influenza and lack of electric power reduced the output considerably during the winter and spring. The recent resumption of work at the Humboldt mines will help to maintain the output of silver. The closing of the Smuggler mine and the idleness of the Wasatch mill, at Silver Plume, will mean a greatly reduced output of silver, lead, and zinc from Clear Creek county. Though development work and production in Gilpin county have been resumed, the closing of the Argo mill, at Idaho Springs, and of the associated Fremont mine will cause a decrease in the production of gold which can be offset only by increased production at several mines. The closing of the Iron Silver Mining Co.'s mines and the Greenback mine and the abandonment of the Western Mining Co.'s operations, all at Leadville, means a greatly reduced output of silver and zinc from the Leadville district. The cancellation of contracts for manganese to be supplied from this district has resulted in the suspension of the shipments of lead-silver ores from mines at which manganese was a product. The low price and the lack of market for lead and zinc resulted in the closing of the Wellington mine, at Breckenridge, and the Eagle mines, at Red Cliff. The snowslides and fire at the Sunnyside mine, at Silverton, have handicapped the operation of that mine. The removal of the pumps from the lower levels at Aspen naturally indicates a heavy decrease in the production of silver-lead ores in that district. The shipments of silver ore from Creede have not equaled those of 1918. The silver output of Boulder county may show a small increase and the Camp Bird mine, at Ouray, may resume milling during the year. Development is going ahead in several districts and mines that have stopped shipping, preparing for the time when metal conditions will justify the resumption of production. The closing of the Globe smelter, at Denver, will put an additional burden of freight charges on shippers from Boulder, Clear Creek, and Gilpin counties, who will now ship to Pueblo. Only four lead smelters are now operating in Colorado, none of them at full capacity, and some at less than half capacity. The recent rise in the prices of metals may, however, bring relief sooner than was anticipated, although gold mines continue to be hampered by the prevailing high costs and fixed price for their product.

Slag as a Structural Material

STAFF CORRESPONDENCE

Slag bricks for general building purposes, slag paving, and slag retaining-walls have been in general use about smelting works for a long time, but to Oscar Rohn, general manager for the East Butte Copper Mining Co., must be given credit for displaying considerable originality in the employment of blast-furnace slag for construction.

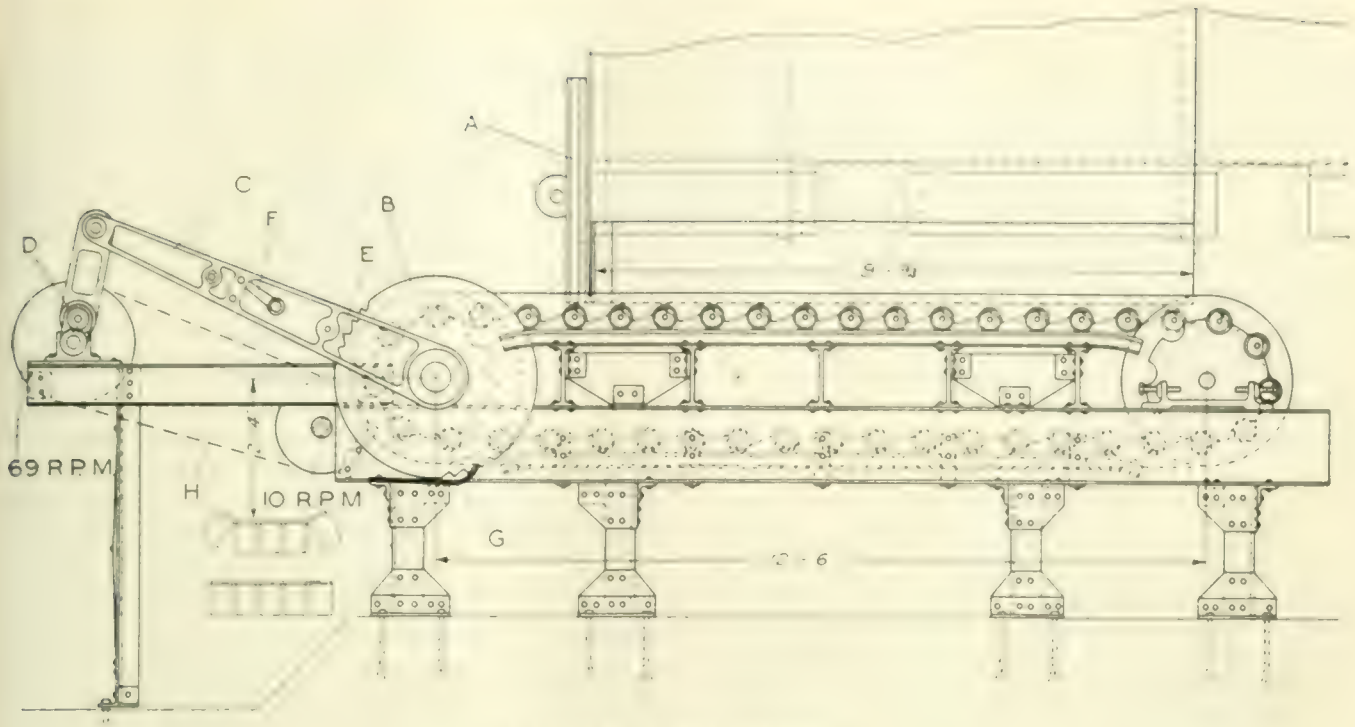
TANKS MADE OF BLAST-FURNACE SLAG

At this company's smelter at Butte, Montana, there are four large tanks built entirely of slag blocks cast in place. One of these tanks is used for thickening flotation concentrate, another for storing water, the remaining two being empty at present. They are 130 ft. in diameter and 14 ft. deep, with walls 12 ft. thick, except for the upper three feet, which has a thickness of 8 ft. only. A level surface was selected on the slag-dump as a site for the tanks, so that their bottoms are also of slag. The forms were made up of half-inch cast-iron plates, 12 ft. by 3 ft., reinforced by light rails, and were used repeatedly, being moved and set up again as soon as the slag had hardened. The design of the plates for the forms could probably be improved, as the cast-iron cracks, requiring to be repaired by steel plates riveted on. The walls of the tanks were cast in tiers of continuous blocks, each block being 12 ft. long by 2 ft. 9 in. high, as shown in the illustration. Joints were broken in successive tiers, and clay was used to plug the corners or joints of the forms as required. The outside surface of the walls steps back a little at every tier of slag blocks to allow the outside plate of the form to rest on the tier below. A gin-pole with a boom was erected in the centre of the tank, the method of pouring being for the boom to pick up the bowl from the slag-pot carriage and swing it around to any desired position for pouring the circumferential wall. The conical slag-pot bowls are easily detached from their mountings on the carriage. The pouring of the wall of a tank required about 34 days. After the tank was completed, the inside surface of the wall was given a coating of gunite.

At one point in the wall there is left a gap, or gate, 8 ft. wide, extending from top to bottom. This is closed by 3-in. plank on the inside, backed by 10-in. baulks of timber, arranged so as to be removable. As originally used for thickening, the flotation concentrate was allowed to run in and settle, the supernatant water being drained off and the gate opened to allow the contents to be shoveled into a car. This method has been improved, and the present system is to run the tank continuously, removing the thickened slime from the centre by an air-lift. Water is taken off at the top by a wooden launder fixed along the inside of the wall.

This method of construction is neat, serviceable, and cheap, and has also been applied to the main dust-chamber, the walls of which are built of slag, the roof being of concrete carried on steel trusses resting on the side-walls. The dust-chamber is 224 ft. long by 70 ft. wide, outside dimensions. The walls are 10 ft. thick by 48 ft. high. A steel stack, 15 ft. in diameter by 150 ft. high, is anchored to a foundation (also of slag), which forms the end of the dust-chamber.

INTERIOR OF TANK, SHOWING GATE AND LAYERS OF SLAG-BLOCKS



A FEEDER FOR WET MATERIAL.

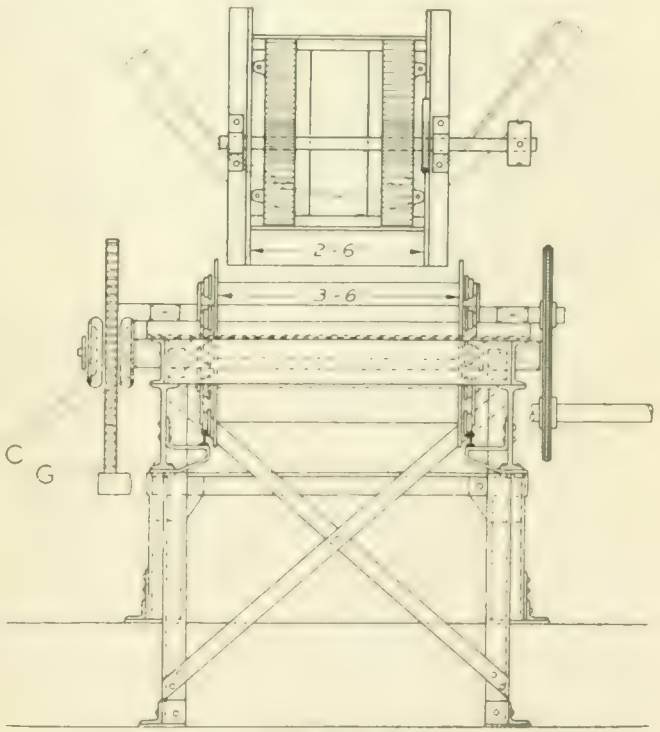
Apron-Feeder for Wet Material

STAFF CORRESPONDENCE

The accompanying drawing shows the arrangement of a standard Link-Belt apron-feeder for handling slime, flotation concentrate, and other wet and sticky material, as used in the Anaconda reduction works. While it is particularly adapted to the feeding of material containing about 15% moisture, it is quite suitable for handling any other class of feed, especially coarse irregular lumps, or, in fact, anything that cannot be handled by the usual method of a belt-conveyor beneath the bottom of the bin. This arrangement is used at Anaconda for feeding the Wedge roasters (one feeder above each furnace), and for getting wet flotation concentrate out of a storage-bin and onto a belt-conveyor, in the preparation of the mixture forming the roaster charge. It is not necessary to mention the difficulties presented by a bin full of dewatered slime, as anyone whose work includes the feeding of such material will have a lively recollection of his experience. Suffice it to say that the arrangement here shown was installed in place of a belt-conveyor.

The faint lines on the drawing show the original outline of the bin. Suitable alterations were made in this bin to accommodate an end-door, *A*, of the usual sliding type moved by a pinion, and it is the raising and lowering of this door that determines the amount of feed. The bin has no bottom, the contents resting on the apron-feeder, which travels at the rate of six feet per minute. The widths of the apron and the door are 3 ft. 6 in. and 2 ft. 6 in. respectively.

As it would be impracticable to arrange a belt-drive for this feeder, a ratchet-and-pawl drive is adopted, which works as follows: The ratchet-wheel, *B*, is of 3 ft. 4 in. diameter. It is on the same shaft as the driving-sprocket of the apron-feeder, and has motion imparted to it by the up-and-down movement of the rocker-arm, *C*, whose length is 6 ft. 1 in. between centres. This



CROSS-SECTION

rocker-arm is of cast-iron, and consists of a pair of limbs that straddle the ratchet-wheel as shown in the end view. It is loose on the ratchet-wheel shaft, and receives its motion from a crank, *D*, designed to give sufficient lift for the pawl, *E*, to engage in successive teeth on the

ratchet-wheel. When the rocker-arm is depressed, the ratchet-wheel revolves through a small arc and the apron-feeder advances with its load.

To stop the feeder temporarily, or when starting after a shut-down, the handle, *F*, is thrown over so that the pawl is loose on the rocker-arm, and the ratchet-wheel remains stationary. To prevent any backward movement of the ratchet-wheel, a flat spring, *G*, of ¼-in. steel, 24 in. long by 2 in. wide, is bolted to any convenient part of the framing so that its point engages the teeth of the ratchet-wheel. There is a chain-drive at *H*.

While no novelty is claimed for this device, it is of interest at the present time when so many plants are treating flotation concentrate.

Coal in Europe

*It has usually been thought that with the coming of peace, despite the appalling destruction of French collieries, the difficulty of Europe supplying itself with coal would pass away. The destroyed mines of France produced 20 million metric tons (of 2205 lb.) in 1913; but even this enormous loss of coal producing capacity represented only 3% of the total production of Europe, which was, in 1913, 730 million metric tons, so it has a relatively small effect on European coal supplies as a whole; there are other greater factors in the deficiency of production. George S. Rice, Chief Mining Engineer of the Bureau of Mines, who has just returned from an extended mining investigation in France, Belgium, Great Britain, the Rhine Valley, and the Saar district, reports that the shortage of fuel that prevailed during the War continues, and that there is probability of a still more serious deficiency unless the United States can come to the rescue by an extensive program of exporting. He finds that, although there was virtually no destruction of the Belgian coal mines, of which the Germans evidently expected to retain possession, the Silesian, Polish, and the Bohemian mining districts have been, and still are, affected by the military fighting and undoubtedly their coal production will suffer; but the most important effect on production in Europe is the general labor unrest and changes in labor conditions which have brought about serious lessening of coal production. The cost of production is from 75 to 150% greater than in 1913, due to increase in cost of labor and material. In most countries the wages of miners have more than doubled. But the most serious changes, because of its position as the big coal-exporting nation of the world, are those taking place in Great Britain, which in 1913 produced 287,000,000 long tons (2240 lb.) and exported 77,000,000 long tons. The output in the year beginning July 16, when the miners' working day was shortened, will be about 70 million tons less than in 1913. The effect of this on Europe will be shown after indicating the coal situation in the principal countries affected.

In France the consumption before the War was 62,000,000 metric tons (of 2205 lb.), and the production 41,000,000 tons. The destroyed mines in the Nord-Pas de Calais field produced 20,000,000 tons, so that if the consumption of France within the pre-war boundaries were the same now as it was then, there would be a deficit of 41,000,000 tons. It is probable that the consumption within this territory will not be as large for some years, as so many factories in the North of France were destroyed. On the other hand, during the War it was necessary to erect new plants in Central and Southern France. Many of these plants will continue to operate and will require coal. The taking over by France of Alsace and Lorraine, and its occupation of the Saar district, will not relieve the situation materially for the present, as a large proportion of this coal is absorbed locally in the industries of Alsace and Southern Germany. Spain in 1913 imported from Great Britain 3,649,000 tons. Holland in the same year imported 12,000,000 tons, of which, however, only 2,018,000 tons came from Great Britain, the balance being imported chiefly from Germany. The former German Empire was a close second in coal output to Great Britain, producing in 1913, 190,109,000 tons of bituminous coal, and 87,233,000 tons of lignite. The largest part of the production was from the Westphalia or Ruhr field in 1913—114,487,000 metric tons—which Germany retains. Upper Silesia, which has been detached from Germany, produced 49,000,000 tons of bituminous coal, and the Saar basin about 17,000,000 tons. The new German Republic will have a yearly production, based on pre-war capacities, of about 124,000,000 tons of bituminous coal and about 90,000,000 tons of brown lignite.

To summarize: the deficiencies in the several countries were before the War supplied by Great Britain, and Great Britain now faces a loss of its export business through reduction in its coal production. On a pre-war basis of consumption the following tabular statement gives the deficiency in the various countries in Western and Northern Europe which must be met by imports:

	Long tons (2240 lb.)
France	20,000,000
Spain	3,650,000
Italy	9,650,000
Holland (other than supplies from Germany)	2,010,000
Sweden	4,560,000
Portugal	1,360,000
Norway	2,300,000
Mediterranean countries (other than Italy)	3,500,000
Denmark	3,030,000
Total	50,060,000

In 1913 Great Britain supplied 31,000,000 tons to North Europe and 32,000,000 tons to France and South Europe, a total of 63,000,000 tons. If the statements made before the Parliamentary Commission are correct, Great Britain will be able to supply only 23,000,000 tons of coal for export during the year, dating from July 16. There is thus a total deficit of approximately 40,000,000 tons, which, if it is to be supplied at all, can be supplied by America only.

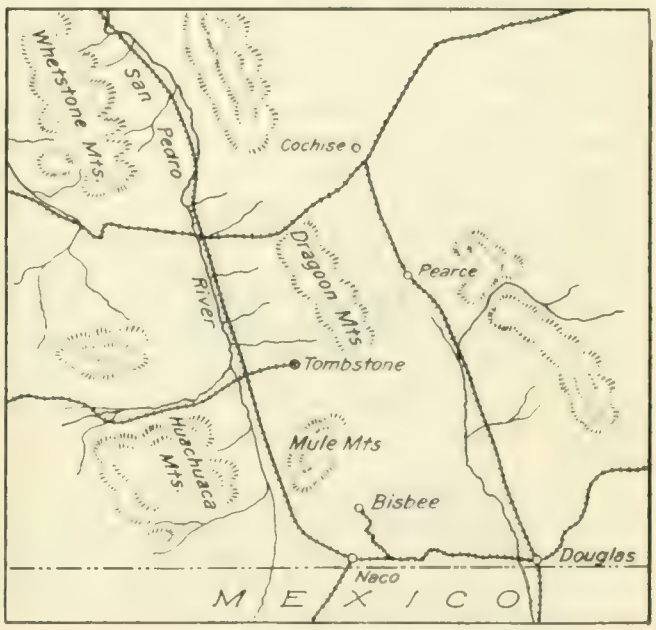
*Abstracted from report by the U. S. Bureau of Mines.

ARIZONA

DOUGLAS AND PARADISE

Douglas.—High-grade ore was recently intersected on the property of the Boras Leasing Co., near Don Luis in the Warren district. The face of a cross-cut from the 300-ft. level, about 200 ft. from the shaft, is said to have penetrated the ore, but the extent of the body has not yet been determined. This lease is on Copper Queen ground between the White Tail Deer and the Night Hawk lease. Six men are employed developing the new strike. Extensive development has been accomplished on the upper levels, considerable ore having been opened nearer the surface. The ore recently found in the Denn mine is developing favorably. On the number 11 cross-cut on the 1600-ft. level a deposit of chalcocite and chalcopyrite is being opened. On the number 6 cross-cut of the 1700-ft. level the entire face of the drift now is in high-grade ore, much of which is said to be native copper. In addition a new orebody was opened recently on the 200-ft. level, adding largely to the known ore-reserves of the property. Arthur Houle, the superintendent, in speaking of the Denn development, said the property now was making a better showing than ever had been expected. The Denn and Shattuck Arizona mines, which although separate corporations are controlled by practically the same interests and have joint management, have resumed shipment of ore to the Calumet & Arizona smelter in Douglas. The size of the shipments has not been announced, but they are said to be on an increasing scale. The Shattuck, an old producer, was practically out of the mining game for several months as a result of a fire on the 800-ft. level. This was extinguished several weeks ago by means of bulkheads and flooding. The Calumet & Arizona smelter at Douglas now is producing sulphuric acid in its auxiliary plant at the rate of 200 tons per day, or approximately 6000 tons per month. This is the capacity of the plant. The bulk of the acid is used by Cornelia, at Ajo, Arizona. Reports from Ajo are to the effect that Cornelia's operations have increased recently and soon will approach normal. Work was started August 4 by the Phelps Dodge Corporation, Copper Queen branch, upon the concentrator that will handle the low-grade ores from Sacramento hill, which will be mined by steam-shovel. About 400 workmen are cleaning up and preparing to resume excavation and foundation pouring, preliminary to erection of the steel framework. Work was begun last fall but stopped when the Government placed an embargo upon structural steel because of war necessities.

Paradise.—The Hilltop mine, in the California mining district, is driving a third tunnel from the Paradise side of the Chiricahua mountains to develop the silver-lead orebodies cut in the two upper tunnels. A number of ore outcroppings found on the surface were cut by the first and second tunnels. In the upper tunnel fifteen different orebodies were traversed, showing that the surface croppings were conical with the base lying vertically below the surface. Some of the bodies were more than 60 ft. wide. The same orebodies were cut in the second tunnel, at a vertical depth of approximately 1400 ft. The third tunnel in the series is being driven several hundred



MAP OF PART OF ARIZONA

feet lower down the hill. Considerable water has been struck, but it is all handled by the tunnels. All the ore can be handled by gravity. Plans for reduction works are under consideration. L. B. Vickroy and J. O. Fife, the latter president and manager of the Hilltop company, formerly were active in development of the Tabotacachi mine in the district of the same name, 50 miles south of Douglas. Revolutionary disturbances caused the temporary abandonment of operations, but the period of enforced idleness has been utilized to develop plans for development of water to supply the needs of the mine and other property in the same district. Mr. Vickroy is satisfied that the mine is one of promise, and expects to open it again as soon as the disturbances in the district have quieted down.

CALIFORNIA

GRASS VALLEY, NEVADA COUNTY, PLACER COUNTY, SIERRA COUNTY.

GRASS VALLEY.—Below is given the full text of the amended agreement between the Mine Workers' Protective League and four of the large mines operating in the Grass Valley district and adopted on July 26. The agreement was signed by J. B. Bennett as president and F. C. Osborne as financial secretary of the Mine Workers' League; George W. Starr for the Empire Mines Co.; A. B. Foote for the North Star Mines Co.; J. A. Fulton for the Idaho-Maryland Gold Quartz Mining Co.; E. R. Abadie for the Golden Center Mining Co. An effort will be made to have the Sultana, Allison Ranch, and Norambagua mines also become parties to this agreement:

To aid our surface and underground men we believe that the following proposition, to remain in force for the period of one year from date, will help the living conditions of our employees and still make it possible for the gold-mining industry of the district to continue:

1. We will abolish the bonus system.

2. We will establish a free market at no cost to the purchaser or seller. This will eliminate the middleman and his profits. This free market will be able to supply goods to the consumer at the lowest cost, overcoming expensive bookkeeping, delivery, and service costs. The free market will handle boots, dry goods, meats, groceries, and in fact goods of every description.

3. We ask that hereafter should any grievances arise that these be taken up with the management and discussed freely and in a proper manner before any drastic action be taken. We welcome the appointment at each mine of a committee of three of our employees, to be chosen by you, to bring to our attention any grievances that may arise, such committee to hold office for six months.

4. Whenever an employee has worked for us continuously for three months he shall be paid 10% of the total wages earned by him during that period. Absence through leave or sickness will not cause the forfeit of this percentage wage increase.

5. As a proof of our sincere desire to aid you we will pay on next pay day one-half of the wages lost by our employees, provided that you return to your former work promptly after the settlement of this matter.

6. We will pay time and a half for overtime and time and a half for Sunday work, with the exception of routine Sunday work such as work in mills or cyanide plants, and pumpmen, engineers, watchmen, and shaft-sinking in mines confining their work entirely to development.

NEVADA COUNTY.—A mining transfer of importance was completed recently when the old Bullion group, comprising the Bullion Consolidated, North Bullion, North Bullion Extension, Leeman ranch, Bullion Lode, Smuggler, La Bruja, Union Jack, and several lesser claims, in all 130 acres, held by the Bullion Con. Gold Mining Co., was transferred to the newly-organized Grass Valley Bullion Exploration Co. The properties named are a mile and a half south of Grass Valley and have a record of $1,000,000 production. The largest development has been on the Bullion ground with an incline-shaft 1500 ft. deep with a production of about $500,000. The Smuggler has a record of some $300,000; the Union Jack, $100,000; and the other claims in lesser proportion from operations much nearer the surface. The mines closed fifteen years ago, the Union yielding $50 ore in a vein from one to four feet in width. The new organization was promoted by George E. Mainhart, C. A. Chapman, and W. D. Seymes, of Ludwig, Nevada, who, with E. J. De Sabla and J. Mulroy, constitute the board of directors. C. A. Chapman has been elected secretary-treasurer and George E. Mainhart, superintendent. The new company is incorporated for $1,000,000. Plans are being considered to erect a modern electric hoisting plant and three pumps to unwater the Bullion shaft. All buildings are to be fire-proof. The preliminary outlay for the purchase of these properties is reported around $300,000. Operations are to commence immediately, and will be under the direct supervision of George E. Mainhart.

PLACER COUNTY.—After a long search the channel of the Glenn Consolidated mine in the Last Chance district has been found with gravel running $25 per car. The mine is owned by Auburn and San Francisco parties.

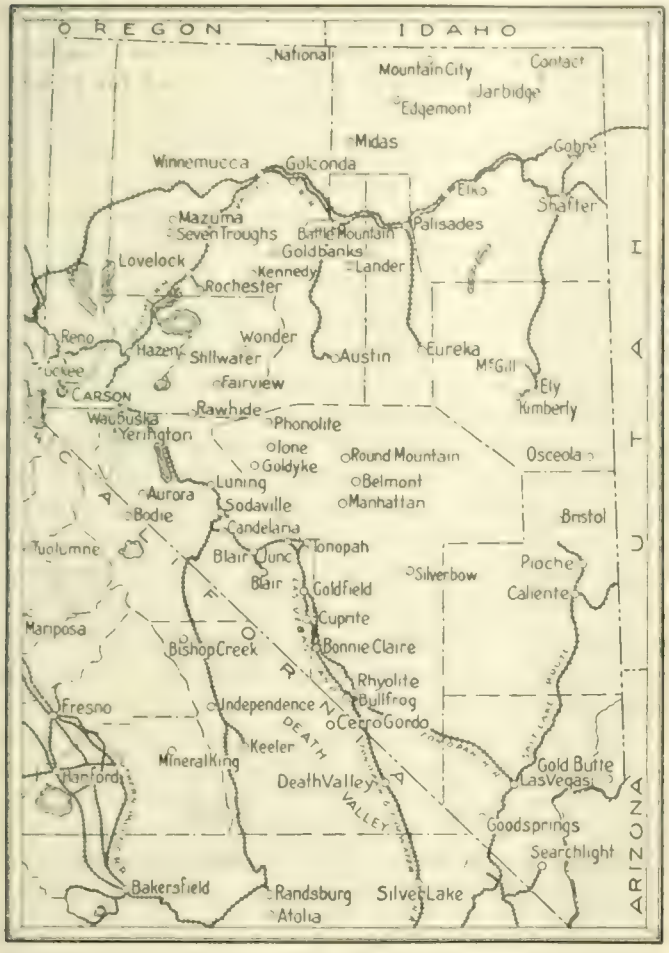
SIERRA COUNTY.—The gravel known to exist in the Brown Bear mine on St. Charles hill was recently encountered in a 40-ft. raise above the main tunnel, with the bedrock pitching west. The main tunnel is now being driven ahead, and when far enough advanced another raise will tap the centre of the channel. Gravel has been found in the Hawkeye tunnel on Rock creek in a 75-ft. raise.

NEVADA

GOLDFIELD AND PIONEER.

GOLDFIELD.—A. I. D'Arcy has resigned as manager for the Tonopah Divide and Brougher Divide companies to devote his entire attention to the Goldfield Development Co. This company is operating the Goldfield Consolidated group and the north half of the Florence Goldfield mine under a five-year lease. It is officially stated that 2,200,000 tons of ore is exposed. On the 380-ft. level of the Combination mine 1,500,000 tons is blocked out, and 200,000 tons on the 120-ft. level of the Red Top. Connections have been established between the 1,500,000-ton reserve on the 380-ft. level of the Combination and the January shaft, and mining the deposit by the caving system is to start soon. Beyond a porphyritic intrusion on the 120-ft. level of the Red top, formerly thought to constitute the hanging wall of the main orebody, large bodies of high-grade ore have been opened. Rich ore has also been exposed on the surface of the Red Top, Combination, and Mohawk mines by settlement of ground induced by caves in the deeper levels. Arrangements have been made to hoist the product of the Red Top through the Laguna shaft.

Sinking the main winze 40 ft. below the 400 ft. level of the Crackerjack is making good progress. From the 440-ft. point cross-cuts will be extended to the Crackerjack vein, which shows a width of 18 ft. at a depth of 380 ft. The ore contains small amounts of bismuth, copper, and zinc. The Crackerjack is the first vein of profitable ore ever found north of the Columbia Mountain fault, and its development is expected to influence favorably operations in other mines in this part of Goldfield. H. G. McMahon is manager. Under management of F. Sommer Schmidt preparations are being made for comprehensive company work on the Florence. Control of the property



MAP OF NEVADA

recently passed to E. L. Whicher of New York, who is also a director of the Goldfield Development Co. The north half of the mine has been leased to the Goldfield Development Co., and leases are being operated on the southern half by the Florence Divide, Crackerjack, Red Hills Florence, and smaller companies. From the 400-ft. workings the Florence Divide recently shipped a carload of ore said to have been worth $130,000. The Silver Pick Co. is operating a lease on the western end of the Combination and driving a cross-cut to seek the continuation of the Combination vein. The Goldfield Merger is extending a series of raises from the cross-cut on the 910-ft. level to reach the Spearhead vein. Work is carried on from the shaft of the Spearhead company. A small amount of work is proceeding in the Atlanta, Great Bend, Lone Star Consolidated, Kewanas, and other properties in the district.

PIONEER.—High-grade ore has been intersected on the 500-ft. level of the Consolidated Mayflower, and development is proceeding to determine the dimensions of the orebody. The directors have decided to improve the mill and to place five of the 15 stamps in immediate commission. An assessment of 1c. per share has been levied, payable before September 1. Sinking the shaft of the Reorganized Pioneer has advanced to a depth of 500 ft. Upon reaching the water-level, calculated to be near the 850-ft. point, cross-cuts will be driven to seek the Pioneer vein, which yielded more than $1,000,000 above the 400-ft. level. All equipment is operated by steam power. W. J. Tobin is manager.

F. Sommer Schmidt, manager for the Florence Goldfield, has announced the first work to be done by the new management. A 1000-ft. cross-cut will be driven from the face of the main south-east drift on the seventh, or 358-ft. level. This will enter territory under a promising outcrop. A 365-ft. cross-cut will be driven west from the shaft on the same level. This will enter the Combination No. 2 claim of the Goldfield Development Co., which has been leased by the Florence, and will be used in prospecting the claim and Florence ground far into the foot-wall of the vein, where no work has been done above this level. The seventh level is considered to be at the most favorable depth, as the bonanza ore-shoots opened by early-day lessees were found in work from this level. These cross-cuts will be the first of 10,000 ft. of development work to be done at an estimated cost of $100,000. This work will not alter the present leasing policy of the company, which will employ miners in the old workings to develop ore for lessees. Smelter returns from the Florence Divide shipment have not been received. Mr. Schmidt indicated that an extension would be granted the Florence Divide company as compensation for the time lost following the burning of the Florence transformer house. The Giles lease, on the ninth level, or far below the recognized bonanza depth, recently shipped a carload of ore assaying $289 per ton. Mr. Schmidt said the "several hundred thousand" tons of ore in the territory leased by the Florence to the Development company should prove of higher grade than the ore to be mined by the latter company in the Combination and Red Top, as it had never been re-worked.

OREGON

WAR MINERALS RELIEF COMMISSION AT MEDFORD.—STATEMENT OF THE DIRECTOR OF THE OREGON BUREAU OF MINES AND GEOLOGY.

MEDFORD.—The War Minerals Relief Commission arrived in Medford from San Francisco on July 27 and began its session in the Federal building the next day. The session consumed the entire week in taking the testimony in the cases of the 174 applicants for relief in the Medford district, which includes the whole of southern Oregon and northern California. The commission con-

sists of three members: Philip N. Moore, of St. Louis, Past President of the A. I. M. & M. E., John F. Shafroth, ex-Governor, Congressman, and Senator from Colorado, and M. D. Foster, ex-Congressman from Illinois. The commission was accompanied by Paul S. Black of Washington, D. C., their counsellor, and H. E. Meyer of Washington, secretary, and several clerks and stenographers. The largest claim to come before the commission in Medford was that of J. F. Reddy, who filed his claim to recover $80,000 losses in chrome mining in Siskiyou county, California. The next largest claim was that of the Manganese Metal company of Tacoma, Washington, for $55,000.15, which it expended in its manganese deposits at Lake creek east of Medford. In his testimony, Herbert Brewitt, president of the company, alleges that the money was spent in erecting machinery, reduction works, building roads, ditches, and dams, and in purchasing property in which the ore was located. Two other large claimants heard were Malne & Reichman, chrome operators in the Fort Jones district in Siskiyou county, California, for $29,435.66, and the Suffern company of Coos county, Oregon, for $27,516.

The following communication was presented to the commission while in session here by Henry M. Parks, Director of the Oregon Bureau of Mines:

"As Director of the Oregon Bureau of Mines and Geology I am appearing before you to make clear the part taken by the Oregon Bureau of Mines and Geology and the members of its staff in encouraging and stimulating the developments of new properties and increase of production of war minerals during certain periods of the years 1917 and 1918.

"In October 1917 I received a letter from George Otis Smith, Director of the U. S. Geological Survey, a copy of which is enclosed, in which he requests me to exert every effort to increase the domestic production of chrome ore, as per following quotation from his letter, being the last paragraph on the first page:

" 'With difficulties limiting the importation of chromite multiplying, it is necessary to exert every effort to increase domestic production of chrome ore and to this end the hearty co-operation of your organization with the U. S. Geological Survey is earnestly invoked.'

"During the month of May 1918 I had occasion to visit Washington, D. C., and called upon Dr. C. K. Leith of the War Import and Export Committee, who called my attention to the impending crisis in war minerals, due to the shortage of ships for importing such materials from foreign countries, and requested me to push with the greatest speed the development of all manganese and chrome properties in Oregon.

"On account of this critical situation in connection with the war minerals demand I ordered the field staff of the Oregon Bureau of Mines and Geology to do everything possible to encourage new development, and speed up the production of manganese and chrome.

"To this end the staff of the Oregon Bureau of Mines and Geology visited many manganese and chrome properties in Oregon and came in direct touch with the miners and prospectors by correspondence and personal conferences. In all cases where in our judgment an extra effort was warranted, we requested on behalf of the Government the speeding up of the production of development.

"This activity on the part of the staff of the Oregon Bureau of Mines and Geology caused many prospectors and miners to engage in an effort to produce these war minerals, as is shown by the fact that Oregon's production of chromite in 1918 over 1917 increased from 7000 tons to 22,500 tons, and the number of producers increased from 26 to 59. Many others engaged in development work, but did not have sufficient time before November 11, 1918, to bring their properties to production."

WISCONSIN

REVIEW OF THE ZINC, LEAD, AND PYRITE INDUSTRIES FOR JULY.

The turning point in the zinc-mining industry from the protracted period of depression that followed the signing of the Armistice came during the month of July. High-grade blende obtained in the Wisconsin field through the process of electrostatic separation was in fair demand at $47 per ton base; premium grades advanced this price so that top was reached at $50. The acute scarcity of labor in all branches of industry found labor agents for large operating concerns combing the field and labor centres for men with meagre results. Wages continued high and sliding scales were adopted which ensured a large return for intense individual effort. Men shoveling 40 cans per shift were paid 9c. per can; over 40 and up to 50 cans per shift, 10c. per can; and over 50 cans per shift, 11c. per can; and to men working six successive shifts an additional bonus of 1c. per can for the entire period was paid. Good shovelers earned as high as $45 per week, and one instance is on record where a human machine earned a little better than $100 in two weeks. An improved tone in the slab zinc markets of the country stimulated ore buying mid-month, the price of high-grade going to $50 per ton base; second grades $47.50. In the third week of the month the price again advanced to $53 per ton base for premium-grade zinc ore, with $50 per ton for second grades. The last week of July brought slight advances, high-grade premium blende going to $53.50 per ton base, and second grades to $51. Although the Wisconsin zinc-ore sellers had for two months been favored on offerings over the quotations published for the Missouri, Kansas, and Oklahoma districts, when high prices struck the field it was found Wisconsin quotations were under those published for the southern field. This was due to the absence from the field all through July of the Grasselli Chemical Co. of Cleveland, Ohio, for years one of the most aggressive buying concerns in this field. The three big smelters operated by the Grasselli interests were closed down on account of strikes at the smelters, and the absence from the field of their buyers resulted in their quotas going to the American Metal Co., of Langeloth, Pennsylvania, at

about $3 per ton less than obtained in the Joplin country.

There was no substantial increase in output in spite of higher prices and good demand. Current production was attuned to the immediate requirements of local zinc-ore refineries, and the reserve on hand at the beginning of July showed little alteration at the close of the month, a conservative tabulation of zinc ore, all grades, on hand showing less than 7500 short tons for the entire field. Substantial gains were recorded during the month on the price offerings for lead ore, flat offers of $62.50 for 80% ore at the beginning of the month advancing $2.50 per ton by mid-month and again advancing in the last week of July to $67.50. Even with this gain in price sellers studiously avoided coming into the market with their product, and shipments for the month of July were comparatively small, the recovery being considered. Careful estimates show that there is in the field 1500 tons or more of high-grade lead concentrate. Sellers declare no lead ore will move in quantity until the price has advanced to $75. Whether holding will bring this figure or not remains to be seen. Carbonate zinc ore production was confined to the mines of the New Jersey Zinc Co. in the northern districts of the field, but aside from the output usually shipped from old producers no especial showing was made. Four new producers were opened up, equipped, and made ready for heavy outputting, but the dull market that has prevailed over a long period for oxide zinc, together with large stocks of the manufactured product in storage, unsold, is keeping down the demand and the production of this class of zinc ore. Independent operators were discussing the feasibility of resuming operations when offerings reached $32 per ton on an assay basis of 40% zinc content. Several hundred tons of choice concentrate was held in bin at the close of the month. Shippers of iron pyrite (marcasite) were few in number all month. Prices were far from satisfactory and the demand for commercial sulphuric acid was weak. Toward the close of the month, however, the price showed improvement and with it went the price for sulphur ores. The Grasselli Chemical Co. was out of the buying on this as well as zinc ores and such shipments as were made for the month went largely to the General Chemical Co. The improved tone in the zinc-ore markets gave new hope to many independent operating concerns that have been shut-down a long time, and several companies resumed production once more. Two new producers with full equipment came into existence in the Cuba district.

Deliveries of ores from mines to refineries in the field, and to smelters direct, were as follows for July:

District	Zinc, lb.	Lead, lb.	Pyrite, lb.
Benton	14,840,000	336,000	1,972,000
Galena	4,906,000	426,000	.....
Cuba City	2,226,000	64,000	774,000
Mifflin	2,130,000	.....	.....
Shullsburg	1,950,000	544,000	.....
Hazel Green	1,562,000	.....	.....
Highland	1,140,000	.....	.....
Linden	50,000	.....	.....
Total	28,804,000	1,370,000	2,746,000

Shipments of high-grade blende from refineries to smelters were reported as follows:

	Lb.
Wisconsin Zinc Co.	1,254,000
Mineral Point Zinc Co.	3,250,000
National Zinc Ore Separator	3,522,000
Linden Zinc Co.	426,000
Oliver Mining Co.	142,000
Block-House Mining Co.	110,000
Total	12,004,000

The total recovery of crude zinc ore from mills for the month of July amounted to 14,548 short tons; total net deliveries out of the field to smelters, all grades, 7067 tons. Sales and distribution was made to Mineral Point Zinc Co., 5171 tons; Wisconsin Zinc Co., 4433 tons; National Separators, 3717 tons; American Metal Co., 1667 tons; Matthiesen & Hegeler Zinc Co., 1119 tons; American Zinc Co., 922 tons; Linden Zinc Co., 606 tons; Illinois Zinc Co., 417 tons; United Zinc & Smelting Co., 380 tons; Lanyon Zinc Co., 146 tons.

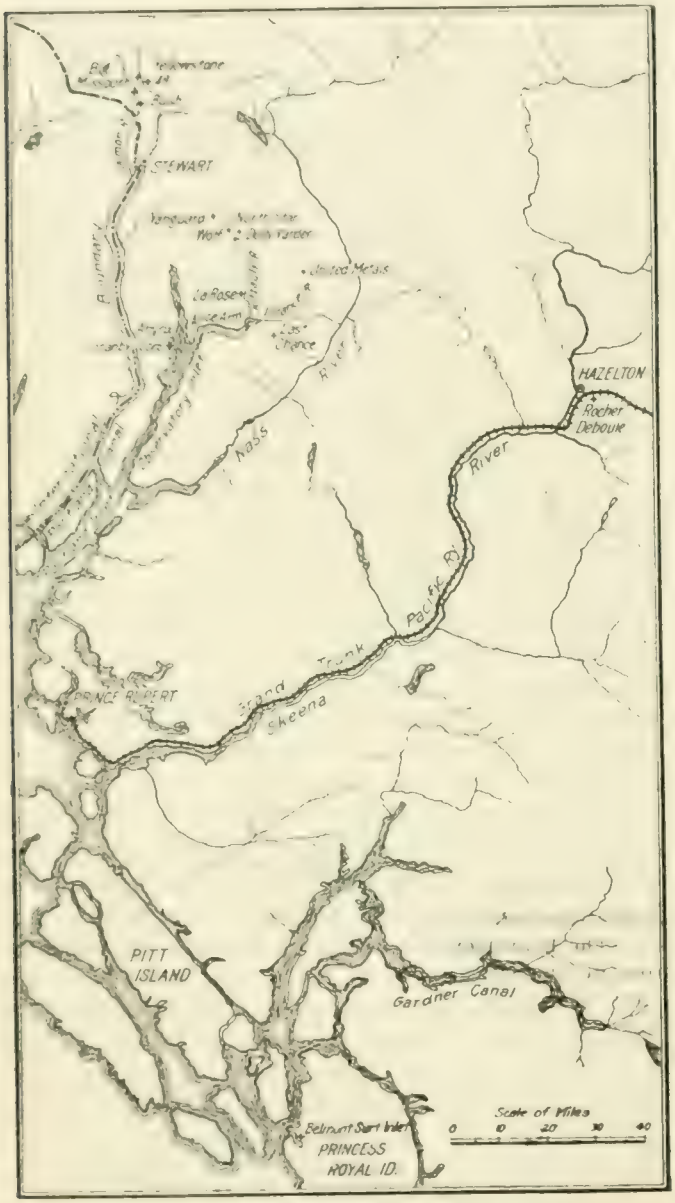
BRITISH COLUMBIA

GENERAL NEWS OF THE PROVINCE.

The Consolidated Mining & Smelting Co. is contemplating the erection of a concentrating plant at Rossland. J. J. Warren, president, S. G. Blaylock, assistant manager, and other officers of the company recently held a conference with the mayor and aldermen of Rossland, with the view to obtaining water and other privileges from the city. The city engineer was instructed to make a survey of the city's water resources, and when he has completed this work another conference will be held between the officials of the company and the city. The company owns a suitable site, and, if water can be assured, it is pretty certain that the company will go ahead with the plant. The first unit will be capable of treating 1500 tons of ore per day, and when that is in working order it is proposed to raise the capacity to 2500 tons per day. Commencing August 1 the Consolidated company raised the pay of all men in the lead-zinc mines and in the smelter 25 cents per day, as the pay of these men had not increased at the same rate as that of the men in the copper mines, the rates fluctuating with the price of the metal. The ore and concentrate received at Trail for the week ended July 31 totaled 9684 tons.

R. F. Green, M. P. for West Kootenay, and Clive Pringle, of Ottawa, have bonded the Silver Bear and Broughton groups, which adjoin the Silver Bell on Kaslo creek. W. E. Newton, who is managing the Silver Bell for Mr. Green and his brother, will supervise the development work on the Silver Bear and Broughton groups. Seattle people are negotiating for the Perrier group, near Nelson. About 50 tons of ore that was shipped from this property recently is said to have realized $4000. A new strike of silver-lead ore has been made on the claim. A body of rich ore has been struck 30 feet west of the new raise from the No. 10 drift on the No. 8 level at the Silversmith mine, at Sandon. The ore-body measures 12 ft., 4 ft. of which is clear galena.

while the balance is high-grade milling ore. A body of excellent ore has been uncovered at the Rambler-Cariboo, in the Slocan division. The ore was cut in No. 9 level, and measures 9 ft. Four feet on the hanging wall and two feet on the foot-wall is solid galena, and there are several stringers between. The No. 10 level in this mine has been driven along the side of the Jenny claim for 180 ft., and exposes a body of ore two to seven feet wide.



MAP OF PART OF BRITISH COLUMBIA

A raise has been put up to the No. 12 level, exposing the same orebody. Thus, the new body has been developed for 220 ft. on the strike and 150 ft. on the dip. A vein has been opened on the Iron Dollar, Fawn creek, Sheep creek, showing 20 ft. of milling ore, some of which can be culled for shipping. The tunnel at the Queen mine, Sheep creek, is in 1200 ft. The Yellowstone vein was cut at 700 ft., and it is expected that the Queen vein will be cut at 1500 feet.

A new plant, replacing the one destroyed by fire in the spring, has been erected at the Old Sport mine, Quatsino sound. Two diamond-drills are in operation. Development at the Ecstall river property, in the Skeena division, which the Granby company has been doing for the last two years, is said to be proving an extensive body of low-grade copper ore. In accordance with its agreement with its employees, with the last rise of two cents in the price of copper the Granby company has raised all wages 25 cents. Miners are getting $5.75, muckers $5.25 per day of eight hours, and laborers 61½c. per hour. The Wild Horse Creek Placer Mining Co., at Fort Steele, has erected machinery for working the bed of the creek. Operations have been resumed at La Rose mine, Kitsault river. Ore shipped from this property last year gave a return of about $350 in silver. The United Metals Co. on the Illiance river has developed an orebody 18 ft. wide, carrying galena and gray copper, some of which runs high in silver. Some of the assays are said to have run up to $1000 in silver. Eighty tons of ore has been taken out and 50 tons is sacked ready for shipping. The Crow's Nest Oil Co. has struck gas at 1825 ft. on its property at Sage creek. The gas ignited and burned the derrick.

The Hon. W. Sloan, Minister of Mines, accompanied by J. D. Galloway, district engineer, is making an examination of the placer and lode mines in the Cariboo district. W. Fleet Robertson, provincial mineralogist, and W. Brewer, district engineer, are watching in the interest of the Government the experimental tests of the Fleet process for the electrolytic smelting of iron ores that are being carried out by the Vancouver Magnetite Iron & Steel Co. The Government provided 46 tons of ore from Texada island and $2000 toward the cost of the experiment. It is Mr. Fleet's duty to substantiate his claim that by his process he can produce pig-iron from British Columbian magnetite at a cost of $13 per ton. In the event of his being successful the Government's money will have been well spent.

The Inland Mining Co. has bonded the Eureka Mines on Eagle creek from the Eureka Copper Mines. The amount involved is stated to be $60,000, of which $17,000 has been paid. The same company has the Granite-Poorman property at Granite under bond and proposes to operate the two properties. Already the Granite mill is operating on Eureka ore. Improvements to the Granite-Poorman plant are proposed, among which is the extension of the tram-line from the mill to the Eureka workings. The Inland Mining Co. is composed of mining men of the State of Washington, H. H. Vincent of Walla Walla being manager, and Alfred Bachtold of the same city, secretary. The mine superintendent is B. Crilly of Nelson, B. C.

Gold placer-mining operations are being carried on at Wild Horse creek near Fort Steele on a larger scale than for the last few years. The Gamble Mining Co., after a twelve days run, closed down operations owing to a break in the flume line on Boulder creek. To test the ground a clean-up was made while the repairs were in progress, with results that were stated to be more than satisfactory.

ASSESSMENT WORK SUSPENDED

A dispatch from Washington, D. C., dated August 7, states that House Joint Resolution No. 76 has been passed and sent to the President for his signature. Although the text of the bill is not at hand, it is understood that it provides for the suspension until December 31, 1920, of the annual assessment work to the value of $100 required on mining claims. Chairman Poindexter and Senator Phipps, Republican, of Colorado, of the Senate Mine Committee, said they had asked for the legislation because of the scarcity of labor with which to do the required work. The exemption from assessments provided in the resolution, however, is limited to five claims of any single claimant.

ARIZONA

Kingman.—The Home Pastime mine at Mineral Park recently shipped a carload of high-grade ore to the smelter. A hoist is being installed at the main shaft and a large pump has been put in to unwater the mine. The old shaft is 300 ft. deep, but development for the present will be carried on at the 150-ft. level. Owing to the present market price of copper it is understood that the Emerald Isle Copper Co. will resume operations immediately. This company has a fair tonnage of oxidized copper ore developed, and recently installed a small leaching and electrolytic plant capable of turning out a ton of copper per day.

Miami.—The A shaft of the Old Dominion Copper Co. is being enlarged to its full size of five compartments between the 18th and 19th levels. This shaft is at present 70 ft. below the 19th level. Extensive development work is being carried on. It is expected that the smelter will be started up the first part of August. A water-softening plant is to be installed at the A shaft power-plant. The Miami Copper Co. has recently completed No. 5 shaft, which is now down 936 ft. The shaft is divided into four compartments by reinforced concrete. Reinforced concrete ore-pockets have also been put in at the main hoisting levels.

Oatman.—The United Eastern Mining Co. has declared a dividend of 7c. per share, payable on August 28 to stockholders of record at the close of business on August 8.

Prescott.—The properties of the Montezuma Mining & Milling Co. in the Bradshaw mountains have been sold to a group of Colorado and California capitalists. The mine is a gold-silver-lead producer and some exploration work was done on the Bear claim by the interests that took it over.

CALIFORNIA

Auburn.—Gravel sampling $35 in gold per car has been encountered in the Glenn Consolidated, according to F. A. Tillotson, the superintendent. The property lies in the Last Chance district and is owned by George McAulay, A. K. Robinson, and other Auburn people. The channel is said to be 2500 ft. long.

Carrville.—Patrick Holland has sold his placer mine on Coffee creek to C. D. Goodman and J. G. Jackson of Oakland. The mine has been a great producer in years gone by, and was locally celebrated for its coarse gold.

Forest Hill.—The James Garvin gravel claims, adjoining the old Mayflower group, have been acquired by a syndicate headed by Edward Dorman of San Francisco, M. S. Eldredge of Detroit, H. E. McCullough of Denver, and Major Hill, recently connected with the American Aviation Service. Equipment is to be installed and development actively pressed.

Igo.—Mrs. Mary V. Ballou has brought suit to eject C. C. McDonald, Charles E. Jameson, and V. V. Aperson from a group of claims at the head of South Fork creek, which, she alleges, was jumped on New Year's day. The Court has issued an injunction forbidding the three defendants to mine any more ore until after the case has been heard. These mines are coming into prominence since the revival of mining for silver in the vicinity of Igo.

Kennett.—The Mammoth Copper Co. has increased the wages of men engaged in development work 50c. per day all around. Miners will receive $4.50 and muckers $4. This is the scale established at the Bully Hill mine at Winthrop. The Mammoth employs 95 men on development work.

San Andreas.—J. E. King has started shaft-sinking on the Keystone mine, near Railroad Flat, and taken the Selkirk group under bond. Good ore is said to be showing in the Keystone, which has produced well.——The Garibaldi quartz mine, at Jesus Maria, is yielding rich ore after years of desultory development. New interests have secured control and development of new territory has begun.

Taylorsville.—Cross-cutting from the 200 and 400-ft. levels of the Gruss mine is in progress, with copper ore of fair grade showing on the 400. The management reports the ore carries silver and gold, and that a 4-ft. vein of molybdenite has been found. It has been decided to install a tube-mill and flotation unit. W. J. Gruss is manager.——The Beardsley Copper Co. has completed a new wagon-road to the mine and arranged for installation of a complete mine plant. A spur is to be built from the Indian Valley railroad to the mine to facilitate shipments of ore. A. L. Beardsley is manager.

Winthrop.—Following the increase in wages granted by the Bully Hill Mines the company has been able to secure a full force of fifty men. Only development work is being done, the purpose being to uncover enough ore to justify an electrolytic plant to cost approximately $750,000. The oil-flotation plant, completed last year, will be a feeder to the electrolytic. No more ore will be shipped to the smelter at Kennett, as the company can do better on its own ground and in its own plant.

COLORADO

Cripple Creek.—Development was commenced August 1 from the Blue Flag Gold Mining Co.'s main shaft, to connect with the Ophelia or Moffat tunnel, at a depth of 1150 ft. Thence the drift on the Happy Year vein will be carried north to a point directly under the Scott shaft of the War Eagle Consolidated Mines Co., and connection made therewith by raise. The Scott shaft is 550 ft. deep. This work will be done under a contract between the Blue Flag company and the War Eagle Consolidated company, which now controls the Moffat tunnel. With ventilation perfected

through the two shaft connections, the Moffat tunnel will become a public utility and will be used for transportation and operating purposes by mining companies, mine owners, or their lessees, on properties along the line of the tunnel. The Moffat tunnel heading is now in the Sheriff claim on Raven hill, one of the War Eagle group, at a distance of 1¼ miles from the portal, which is on the western slope of Gold hill about a mile south of Cripple Creek. Production for the second quarter from properties of the Vindicator Consolidated company totaled 3215 tons on company account and 5725 tons by lessees. The net earnings of the company approximated $34,000. The Carlton interests have announced their intention to better lease conditions by issuance of new leases on properties controlled, with a lower scale of royalties on ores marketed and better working conditions. Other companies and mine owners, it is expected, will follow suit and bring about greater activity and accompanying increase of production. The Patterson Bradley Leasing Co., which is operating the Specimen mine on Bull hill, is reported to have intersected a strong body of ore at a depth of 1200 ft. Shipments will soon be leaving the property.

IDAHO

Kellogg.—Agitators among the employees of the Bunker Hill & Sullivan Mining company have succeeded in forcing such a situation that a strike appears almost inevitable. It is stated by reliable investigators that most of the men are contented and do not want trouble, but that the organizers and strong union men are using methods of intimidation and packing meetings with strike voters, which it is feared may result in calling a strike against the wishes of the majority. A committee of employees has attempted to see General McWade, the Federal Mediator, in order to advise him that most of the men are satisfied with their wages and living conditions, and to ask him to use his influence to prevent coercion by the organized and aggressive minority. The Bunker Hill has an enviable record for length of service of many of its men, and it is stated that most of the disturbance is caused by malcontents who are new to the district.

MICHIGAN

Calumet & Hecla's new flotation plant will be in operation in September, according to present plans. The steel work is now all up. When this plant starts all conglomerate sands will be treated by flotation. The sand pile is showing a richer return of copper than ever, the betterment running three pounds per ton. Quincy is changing the mill over in order to utilize the added ball-mills and slime-tables. These are now in operation and it is expected that they will result in an increased production of copper for August.

MISSOURI

Webb City.—The recent increase in ore prices has put new life into the Webb City district, and the first drilling for new ore discoveries to start in this once productive field is being done on the Fremont lease north of Webb City.

UTAH

Alta.—Development at the South Hecla mine is reported to be having encouraging results. Good ore was recently intersected by a winze below the Dwyer tunnel, at a vertical depth of more than 500 ft. The company is shipping 75 tons per day, and employs 90 men. Col. George H. Watson, the manager of the mine, considers conditions in the camp exceptionally promising.

Park City.—Mining conditions are improving here daily. New names are being added to the pay-rolls and new work is being planned for some of the companies. The East Carbonate is driving to cut the contact. Streaks of ore are being encountered.

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

D. C. Jackling has returned from Alaska.

M. O. Carlson has returned from Burma to Denver.

George A. Packard, of Boston, is in San Francisco.

William Bayly, of Los Angeles, is at the Palace hotel.

W. E. Simpson of Cobalt is on his way to Glasgow, Scotland.

Kirby Thomas has been examining asbestos mines in Quebec.

A. R. Whitman has returned to New York from Northern Ontario.

William Macdonald has returned from Mason, Nevada, to Berkeley.

F. G. Cottrell is expected at Washington on his return from France.

L. V. Cummins returned to Japan on August 2 after a trip to New York.

Alfred C. Lane has returned from France and is now at Cambridge, Massachusetts.

Robert A. Kinzie has been appointed consulting engineer to the Engels Copper Company.

F. A. Beauchamp has left for Lark, Utah, and expects to be away from San Francisco about ten days.

H. S. Denny has joined with **J. H. Freeman** in organizing the Denny Chemical Engineering Co., in London.

Blamey Stevens, manager of the Lane-Rincon mines, at Temascaltepec, Mexico, is now at El Paso, Texas.

A. F. Keene, of New York, has been inspecting the Trona Corporation's operations at Searles lake, California.

Bancroft Gore has been appointed an Associate Editor of the 'Mining and Scientific Press'. He is now at Boston.

Fred Hellmann and **E. S. Berry** visited the Nevada Consolidated Copper mines at McGill, Nevada, during last week.

Mark Walker has removed his office and laboratory to 512 Wesley Roberts building, Third and Main streets, Los Angeles.

Welton J. Crook left August 6 for British Columbia to install a concentrating plant for the Iron Mountain Limited at Salmo.

B. L. Thane and **Howland Bancroft** announce a consolidation of their engineering offices in the Crocker building, San Francisco.

Henry P. Smith, general manager for the Guanajuato Reduction & Mines Co., has returned from Los Angeles to Guanajuato.

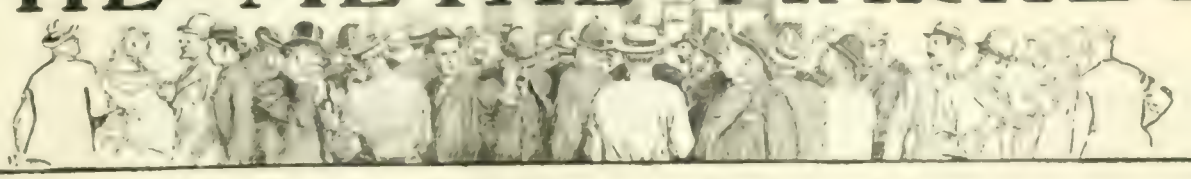
Arthur Lakes, Jr., Major in the U. S. Army, has returned to Denver from service in France, where he was attached to the construction service.

James F. Kemp, Horace V. Winchell, Charles K. Leith, Walter H. Wiley, Albert Burch, and **W. H. Emmons** are at Butte as geological experts in the Elm Orlu case.

L. W. Trumbull, for the past six years State Geologist of Wyoming, and formerly Professor of Geology in the State University, has resigned to devote his time to private practice. After September first his address will be 1835 Gaylord street, Denver.

Charles E. Prior, formerly with the Hedley Gold Mining Co., in British Columbia, and recently returned from military service in France, will be married to the daughter of **Gomer P. Jones**, resident manager for the Hedley company, on August 21, at Chatham, New Jersey.

THE METAL MARKET



METAL PRICES

San Francisco, August 12

Aluminum dust, cents per pound	50—60
Antimony, cents per pound	9.50
Copper, electrolytic, cents per pound	24.00
Lead, pig, cents per pound	6.25—7.25
Platinum, bars, per ounce	$105
Platinum, 10% iridium, per ounce	$121
Quicksilver, per flask of 75 lb.	$105
Spelter, cents per pound	9.50
Zinc dust, cents per pound	11.00—13.50

EASTERN METAL MARKET

(By wire from New York)

Aug. 12.—Copper in London is weak and market is slumping here. Lead market is unsettled, suffering from outside offerings. Zinc is quiet but fairly firm.

SILVER

Below are given official or ticker quotations, in cents per ounce of silver 999 fine. From April 23, 1918, the United States government paid $1 per ounce for all silver purchased by it, fixing a maximum of $1.01½ on August 15, 1918, and will continue to pay $1 until the quantity specified under the Act is purchased, probably extending over several years. On May 5, 1919, all restrictions on the metal were removed, resulting in fluctuations. During the restricted period, the British government fixed the maximum price five times, the last being on March 25, 1919, on account of the low rate of sterling exchange, but removed all restrictions on May 10. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the normal rate of exchange.

Date	New York cents	London pence	Average week ending	Cents	Pence
Aug. 6	108.75	57.00	July 1	108.83	53.48
7	109.37	57.37	" 8	107.52	53.47
8	110.00	58.00	" 15	106.35	53.38
9	111.37	58.50	" 22	104.85	54.25
10 Sunday			" 29	106.54	54.99
11	111.62	58.50	Aug. 5	108.08	55.17
12	112.37	58.75	12	110.58	58.02

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	75.14	88.72	101.12	July	78.92	99.62	106.36
Feb.	77.54	85.79	101.12	Aug.	85.40	100.31	....
Mch.	74.13	88.11	101.12	Sept.	100.73	101.12	....
Apr.	72.51	95.35	101.12	Oct.	87.38	101.12	....
May	74.61	99.50	107.23	Nov.	85.97	101.12	....
June	76.44	99.50	110.50	Dec.	85.97	101.12	....

COPPER

Prices of electrolytic in New York, in cents per pound

Date		Average week ending	
Aug. 6	22.75	July 1	18.37
7	22.50	" 8	18.53
8	22.25	" 15	20.29
9	22.25	" 22	21.50
10 Sunday		" 29	23.50
11	22.00	Aug. 5	22.87
12	21.50	12	22.20

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	29.53	23.50	20.43	July	29.67	26.00	20.82
Feb.	34.57	23.50	17.34	Aug.	27.42	26.00	....
Mch.	36.00	23.50	15.05	Sept.	25.11	26.00	....
Apr.	33.16	23.50	15.23	Oct.	23.50	26.00	....
May	31.69	23.50	15.91	Nov.	23.50	26.00	....
June	32.57	23.50	17.53	Dec.	23.50	26.00	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound:

Date		Average week ending	
Aug. 6	7.75	July 1	7.36
" 7	7.72	" 8	7.45
" 8	7.60	" 15	7.74
" 9	7.60	" 22	8.17
" 10 Sunday		" 29	8.32
" 11	7.60	Aug. 5	7.64
" 12	7.60	12	7.64

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	9.75	7.78	7.44	July	8.98	8.72	7.78
Feb.	10.45	7.97	6.71	Aug.	8.58	8.87	....
Mch.	10.78	7.67	6.53	Sept.	8.33	9.58	....
Apr.	10.20	7.04	6.49	Oct.	8.32	9.11	....
May	9.41	7.92	6.43	Nov.	7.76	8.75	....
June	9.63	7.92	6.91	Dec.	7.84	8.49	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. Prices in dollars per flask of 75 pounds.

Date		Date	
July 10	100.00	July 29	105.00
" 11	100.00	Aug. 5	105.00
" 22	100.00	" 12	105.00

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	81.00	128.06	103.75	July	105.00	120.00	100.00
Feb.	126.25	118.00	90.00	Aug.	115.00	120.00	....
Mch.	113.75	112.00	72.80	Sept.	112.00	120.00	....
Apr.	114.50	115.00	73.12	Oct.	102.00	120.00	....
May	104.00	110.00	84.80	Nov.	102.50	120.00	....
June	85.50	112.00	94.40	Dec.	117.42	115.00	....

LEAD

Lead is quoted in cents per pound, New York delivery.

Date		Average week ending	
Aug. 6	5.75	July 1	5.40
" 7	5.70	" 8	5.40
" 8	5.60	" 15	5.42
" 9	5.60	" 22	5.62
" 10 Sunday		" 29	5.91
" 11	5.60	Aug. 5	5.87
" 12	5.60	12	5.64

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	7.64	6.85	5.60	July	10.93	8.03	5.53
Feb.	9.10	7.07	5.13	Aug.	10.75	8.05	....
Mch.	10.07	7.26	5.24	Sept.	9.07	8.05	....
Apr.	9.38	6.99	5.05	Oct.	6.97	8.05	....
May	10.29	6.88	5.04	Nov.	6.38	8.05	....
June	11.74	7.59	5.32	Dec.	6.49	6.90	....

TIN

Prices in New York, in cents per pound:

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	44.10	85.13	71.50	July	62.60	93.00	....
Feb.	51.47	85.00	72.44	Aug.	62.53	91.33	....
Mch.	54.27	85.00	72.50	Sept.	61.54	80.40	....
Apr.	55.63	88.53	72.50	Oct.	62.24	78.82	....
May	63.21	100.01	72.50	Nov.	74.18	73.67	....
June	61.93	91.00	71.83	Dec.	85.00	71.52	....

ORES

Tungsten: The market has seen but little change. It will be some time before it is clear what will be done in the matter of tariff to protect the industry, which is regarded as much needed. A little more inquiry is coming from Europe, but transactions for export are few and comparatively small. Chinese ore has sold around $7.25 per unit. Quotations range from $7 to $15 per unit in 60% concentrate. Some business in ferro-tungsten has been done at $1.15 per pound of contained tungsten.

Molybdenum: The market is inactive. The last price at which sales were made was 85c. per pound of MoS_2, spot delivery.

Manganese-Iron Alloys: Domestic ferro-manganese is generally held at $115 delivered east of the Mississippi and north of the Ohio river, but as low as $110 has been done to meet the quotation of English makers, which is $105, c.i.f. seaboard. It is to be noted that the British material is 76 to 80%, while the domestic is 78 to 82%. Spiegeleisen is stronger at $35 for 18 to 22%, but not a great deal is being done.

FOREIGN EXCHANGE

Foreign exchange declined badly again during the week. Sterling demand went to 4.29¾ on August 6, which came within 3½c of the extreme low established several weeks ago. August 7 showed a slight recovery. Francs receded to another new low at 7.74 to the dollar, and lire touched 8.90. With an unusually large volume of commercial bills appearing and heavy offerings of the various remittances, the market again approached a demoralized condition. Some of these drafts had apparently been held back in hope of a recovery that did not materialize. Reports from Russia tell of a rate of 75 roubles to the dollar, or 1-1/3 cents per rouble, against normal quotation of 51¼ cents. The same fundamental causes that have been operative for some time are still adversely affecting the exchanges—the heavy trade balance against Europe and the delay in formulating remedial measures on this side. The committee of the Foreign Exchange Bankers' Association gave further consideration and accumulated more data on the subject at a meeting on August 6. The discount on Canadian currency in terms of our dollar still persists near the maximum, with the present margin about 5c., as against a record of 5¾ recently. The same story of unrelieved trade balances applies here also.

Gold. It was announced in London on July 24 that an agreement between the Bank of England and representatives of the gold mining companies of the Transvaal had been signed, whereby the free market in the gold produced by these companies is re-established, thus removing the restrictions on export which prevailed during the War.

Quotations on August 12 are as follows:

Sterling:	Cable	4.33¾
	Demand	4.32¾
Francs:	Cable	7.57
	Demand	7.59
Lire:	Demand	8.84

Eastern Metal Market

New York, August 6.

The entire situation in metals is adversely affected by the menace to transportation embodied in the threat of railroad employees to start a country-wide strike, while the heavy declines in Wall Street from the same cause have a damaging sentimental effect in the same direction. Most of the metals either show declines or have an easier tendency.

Copper is lower than a week ago.

The interest in tin is largely of a speculative character, based on predictions that the rate for pounds Sterling will go lower.

Outsiders have what business there is in lead and are underselling the leading interest. Consumers are well supplied for the present.

A slight flurry of buying zinc in the latter part of last week ended abruptly and the market is now softer.

Antimony is inactive, with the quotation unchanged.

IRON AND STEEL

In the Cleveland and Chicago districts actual stoppage of blast-furnace and steel-mill operations by strikes of railroad employees has brought home what a general strike of railmen would mean, and the situation is extremely disturbing. Iron and steel plants at Cleveland, Gary, and South Chicago are affected, the Illinois Steel Co. banking 7 out of 12 blast-furnaces at South Chicago. At Gary 14 out of 44 open-hearth furnaces are idle. The production of pig-iron gained in July, the total for the month being 2,428,541 tons or 78,340 tons per day, against 2,114,738 tons in June or 70,495 tons per day. On August 1, 239 furnaces were in blast against 200 July 1. Pig-iron is strong, Southern makers in particular showing a tendency to advance their quotations. Nevertheless, on large lots concessions are reported. Plates continue to be the most inactive of finished steel products, with structural shapes coming next. For bars there is an active demand. The big demand continues in wire products, sheets, and tubular goods, the last named being required by oil-well and line developments. Here and there advances in prices are reported, as in rail carbon bars, which Chicago makers have put up $2 per ton, and large structural rivets and bolts and nuts. An interesting export inquiry is for 20,000 tons of structural steel required by the Tata Iron & Steel Co., India. The steel is wanted for plant extensions, and could be rolled by the company itself were it not that the British government has requested it to concentrate on the production of steel rails. Belgium has already exported small quantities of pig-iron, bars, and sheets. Belgian bars, prior to the War, and sheets also, were laid down in United States ports both on the Atlantic and Pacific Coast at prices then disturbing to American makers. It may be said that there is but little danger of competition from that source at this time.

COPPER

The quiet market referred to a week ago is now a little more accentuated, as might be expected under existing circumstances. In July a large tonnage of copper was taken by consumers and they are now resting. As already mentioned, the threatened country-wide railroad strike is having a quieting effect on the situation, lessening what buying there might be under the circumstances. Should a strike materialize it is expected that the price of stocks at consuming points will advance sharply, as the metal in hand will be a sure thing. Prompt deliveries also will be strengthened in all likelihood, but a damper may be placed on futures. An interesting item which came to light in Boston is that the Copper Export Association has sold 1000 tons of copper (electrolytic) for delivery to Germany, the first to be sold to that country in some time. Just how the sale was negotiated, and the financial arrangements made, have not been divulged, but the sale is confirmed. The association has sold approximately 100,000,000 lb. of copper. Prices have declined in the week, and a weak tendency is shown generally, second-hands taking what business there has been. Electrolytic today is around 22.50 to 22.75c. for prompt delivery. For futures a premium is asked, the quotations running up to 25.50 to 24c., for September and October. Most of the producers are unwilling to sell far ahead, which is natural in view of the uncertainties of the situation. Lake copper is scarce and averages about ¼c. over the price for electrolytic.

TIN

Tin for shipments from the East in the last quarter of the year is quoted around 53 to 53.25c. For earlier delivery, including September, 54c. is the quotation. Early shipment Straits tin from England is about 55c., and Lamb & Flagg for prompt shipment is 54.40c. American high-grade metal is held at 66.50c., and American 99% pure at 65.50c. Spot Straits is unchanged at 70c., New York. The market is quiet with speculation, based on the probable course of the exchange rate for pounds Sterling, still a factor. Some sellers are willing to sell 1 to 2c. lower than conservative houses because they believe the value of the pound will drop lower; while some consumers are slow to buy for the same reason. Spot stocks are scarce. Some new has arrived in the past few days, but it had no effect on the market as it went directly into consumption. An authority states that no Chinese tin is obtainable, all being shipped from Hongkong to Shanghai where it is being used in the manufacture of tinfoil and household utensils. Only re-sale Banca is available. On the whole the market is quiet.

LEAD

The quotation of the leading producer is unchanged at 6c., New York, and 5.75c., St. Louis, but small producers quote 5.87½c., New York, and other outsiders ask 5.75c., New York. The market has turned quiet, the recent demand having been satisfied. In fact consumers are no longer satisfied even at the lower prices quoted. Producers are making but little effort to sell, for the good reason that they know how their customers are supplied.

ZINC

Prompt delivery metal is held at about 7.95c., New York. Consumers are not interested in the market, but late last week there was some speculative interest shown. With the news of the threatened strike even this subsided, and there are indications of weakness. Most of the producers are said to have but little metal to offer this side of October, a situation partly due to the shutting down of some large plants because of labor trouble. The electrolytic refinery of the Anaconda company is down, as previously reported in print. It can produce 4000 to 5000 tons per month. On Saturday last zinc-ore prices broke about $5 per ton to $47.50.

ANTIMONY

In a market almost dead, the quotation is unchanged at 9.37½c., New York, duty paid, for early delivery.

ALUMINUM

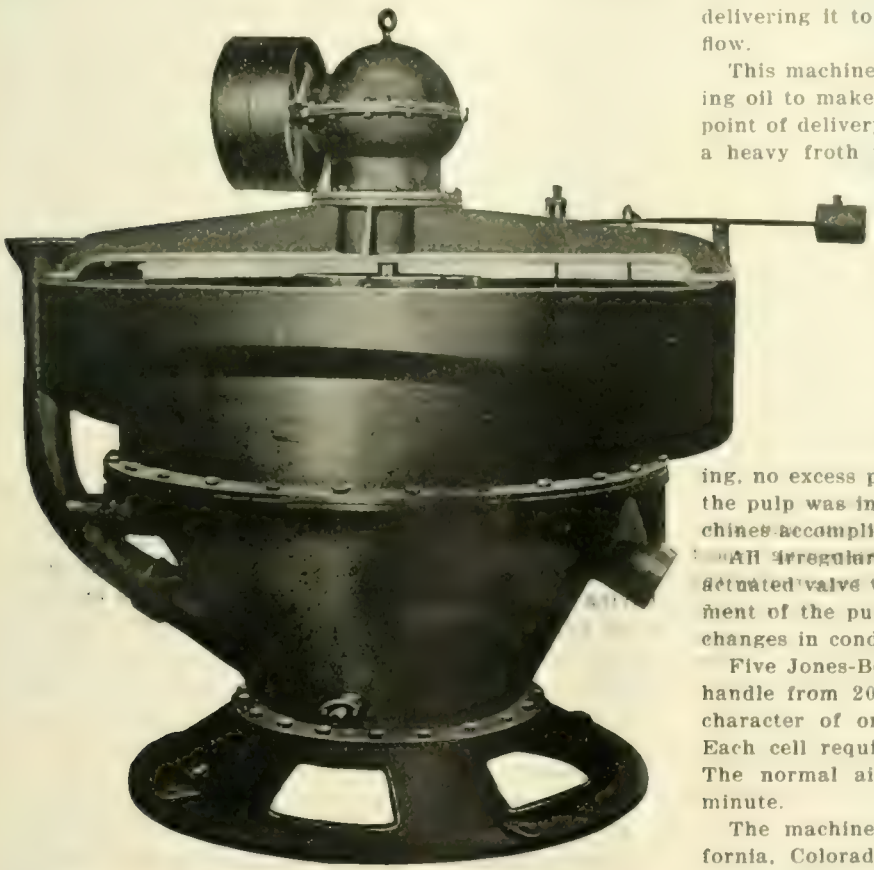
Early delivery, 98 to 99% pure, No. 1 virgin alumium is unchanged at 32 to 33c., New York.

INDUSTRIAL PROGRESS

INFORMATION FURNISHED BY MANUFACTURERS

AN IMPROVED FLOTATION MACHINE

A flotation machine known as the Jones-Belmont cell has recently been perfected by Mr. A. H. Jones, of the Belmont group of mines, who has now become associated with Chas. Butters & Co., Ltd. The cell is constructed of cast-iron, sheet steel, or concrete as conditions may require. It combines the advantages of both mechanical and pneumatic agitation and is so constructed that uniform circulation of pulp is assured at all points. The advantages of mechanical agitation are secured through introducing pulp between two cones of 60° slope, delivering to the bottom of a central



The Jones-Belmont Flotation Machine

barrel, having both impellers and baffles, which, in addition to emulsifying, also acts as a pump discharging pulp from the top of the barrel with a swirling motion over a circular fabric blanket. At the outer edge of this blanket, pulp is either returned between the two 60° cones over about nine-tenths of their periphery to the bottom of the impeller-barrel, discharged to the next cell, or run off as tailings. These operations are regulated by an automatic, float-actuated valve, which ensures a number of complete circulations of pulp through the impeller-barrel and over the blanket in each cell before being discharged. By this means the sulphides are allowed every possible opportunity for emulsification and frothing and complete circulation is ensured.

Considered as a pneumatic machine, the device possesses many advantages. The pulp zone above the blanket has only a shallow depth, requiring low air-pressure to ensure satisfactory results and a short upward travel of sulphides to reach the froth zone. The delivery of pulp close to the blanket, and with considerable velocity across it, tends to turn over both gangue and sulphides many times during each passage, allowing every opportunity for the sulphide content to become disengaged from the gangue and join the froth. The decided swirl of the pulp over the blanket tends to carry the froth toward the periphery by centrifugal force, delivering it to a launder at the rim in a free, continuous flow.

This machine does not require the use of surplus gathering oil to make and sustain the froth across the cell to the point of delivery and so avoids difficulties in breaking down a heavy froth in the subsequent operations of thickening and dewatering.

In actual use this machine has never developed any circulating difficulties in handling gangue which is ground fine enough to free its sulphide content for flotation; neither have the heavier sands accumulated on the blanket. A series of eight machines handling hard quartz ground to pass 60-mesh, was closed down for twelve hours without any other precaution than shutting off the power and feed. On starting, no excess power was required to free the impeller, and the pulp was in perfect circulation in five minutes, the machines accomplishing a regular delivery of froth.

All irregularities of feed are compensated by a float-actuated valve which ensures a constant pulp-level. Adjustment of the pulp-level and air can readily be made to suit changes in conditions.

Five Jones-Belmont cells, four roughers, and one cleaner handle from 200 to 500 tons per day, depending upon the character of ore, sulphide content, and dilution of pulp. Each cell requires a maximum of 2½ hp. under full load. The normal air-consumption is 120 cu. ft. per cell per minute.

The machine has been used in British Columbia, California, Colorado, Nevada, and South America, where excellent results have been reported by the operators.

The Jones-Belmont cell is sold exclusively by Chas. Butters & Co., Ltd., 90 West street, New York. This company announces that an experimental station for flotation work will be opened shortly in Salt Lake City. Requests for further information concerning the cell should be addressed directly to the New York office.

It has been announced that Charles Butters, who has hitherto been the managing director of **Chas. Butters & Co., Ltd.**, is no longer associated with the company in any way, but that arrangements have been completed whereby the company retains all its former business and assets intact. American offices have recently been established at 90 West

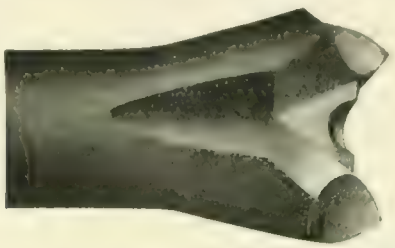
street, New York, where a general business in metallurgical engineering and in the application of their special processes and apparatus to metallurgical and chemical problems will be conducted under the direction of F. L. Bosqui. Correspondents are requested to send all communications to this address.

IS YOUR STEEL TOO LONG?

By F. M. Lee* and J. A. Noyes†

The proper length of drill steel and the number of pieces of steel in a set to drill to a given depth should be given serious consideration. Too often the governing feature seems to be the length of the feed-screw of the rock drill or hammer drill in use. A customary feeding length or run is 2 ft. Consequently the inference seems to be that 24 in. is automatically determined as the proper length of steel changes, and for drilling, say, a 10-ft. hole, five steels will be used, 2, 4, 6, 8, and 10 ft. in length, respectively.

This practice is justified, provided the rock in which the drilling is being done is not so hard, or so abrasive as to wear the gauge or dull the bit unduly. In many mining districts, where the question of drilling efficiency has been



Sullivan Double-Arc Double-Taper Bit

carefully studied, the character of the ground is considered the determining factor, and steel is furnished to the drill runners in 12-in. lengths or even in 9-in. lengths in extreme cases, even though the drilling machine is equipped to handle a 24-in. or longer run.

A bit whose cutting edge is dulled in the first 12 in. of the run or whose gauge loses ⅛ in. or more in the same distance, certainly cannot drill efficiently for the second 12 in. of a 24-in. run. If a new steel of the same length is inserted to finish the run, it naturally has the same starting gauge as the worn bit, and the result is that if the hole is bottomed at all, it is only by throwing an undue strain on the cylinder and rotating mechanism of the drilling machine, by excessive sledging of the steel or by squibbing, which takes considerable time and wastes powder and fuse. The chances are about even that the bit will be broken or stuck in the hole in the operation.

It should be pointed out that if steel is made up in 12-in. lengths, there is nothing to prevent skipping a length and drilling 24 in. with the next longer steel, where conditions are favorable.

Another important factor is the change in gauge with each successive length of steel, and the shape of the bit itself. Many mines are still using a change of gauge as large as ¼ in. for each run of 24 in. The bits used in such cases have the ordinary straight taper, which usually is 14° or thereabout. Experiments have indicated that the Sullivan double-arc bits with a 5° taper, running about 1 in. back from the cutting face, and carrying a 14° taper from that point to the rear end of the wing, provide much greater cutting efficiency. This is indicated by the fact that the gauge changes may be cut down 50%, thus decreasing the size of the starter or first run of steel materially, and at the same time, permitting a hole of the same diameter to be bottomed as was secured with the old style bits. At a mine in the Joplin district, using double-arc bits of ⅛ in. variation in gauge, the tonnage per drill-shift has increased 20% since these bits were substituted for crossbits with ¼-in. drop in gauge. This drilling was done in 'stope' (flat) holes 10 to 14 ft. in depth for 1¼-in. powder. The starters formerly used with single taper and crossbits were 3-in. gauge. The starters at present used with the double-arc, double-taper bits are 2⅞-in. gauge.

At another mine in the same district, a saving of 20% in cost per ton per drill-shift is being made by this means as compared with the crossbits, having single taper.

At a mine in the Republic district of northern Michigan, which formerly used 14° single-taper bits, double-taper bits were substituted with the following results:

The gauge of the starting steel was decreased from 2½ to 2¼ in. It was possible to secure a 10-in. run from each steel instead of an 8-in. run as was the previous case. The drop in gauge is ⅛ in. During January and February, 1918, 18,096 tons of ore were mined and 17,581 steels were sharpened. During November and December, 1918, 24,940 tons of ore were mined and only 10,991 steels had to be sharpened to produce this tonnage. During the first two months of the year, the old type of bit was in use. During the last two months, the new type of bit was used exclusively. With the old bit, 1.05 tons of ore were broken per steel sharpened, while with the double-taper bit 2.25 tons of ore were broken for each steel that went to the blacksmith shop for re-sharpening.

The double-taper, double-arc bit to which reference is made above can be sharpened by hand with suitable dies and dollies, but can be made up much more accurately and, of course, very much more rapidly in Sullivan drill sharpening machines, which can be equipped for this purpose with special adjustable gauging dies on the vertical hammer, providing for 16 changes in gauge on the same set of dies by merely adjusting a thumb screw and key.

*2624 W. Lake St., Chicago.

†Alworth Bdg., Duluth.

COMMERCIAL PARAGRAPHS

The Chicago Pneumatic Tool Co. has announced the appointment of N. S. Thulin as special railroad representative on the staff of S. C. Sprague, manager of Western railroad sales.

United Filters Corp. has announced a line of filter-presses of the plate and frame and also recessed types to be known as the 'United'. The company is now in a position to furnish the three types of filters in general use, the pressure leaf type, represented by the Kelly & Sweetland filters, the continuous suction type, represented by the American filters, and the plate filter-presses known as the 'United'. Bulletin No. 50 illustrates these new filter-presses, and will be sent on request.

The Lunkenheimer Co., Cincinnati, has announced its intention to build a new plant on a 70-acre site at Carthage, a suburb of Cincinnati, on the Toledo division of the Baltimore & Ohio Southwestern railroad. Buildings will be of one, two, and three-story types, of steel and concrete construction, and there will be provided all modern devices for the manufacture, handling, and transportation of raw material, part finished and finished products. The undertaking will represent an outlay of approximately $2,000,000. The welfare of the employees has been given special consideration. A piece of land of about eight acres has been reserved as a recreation centre, upon which will be erected an assembly hall, club rooms, base-ball grounds, tennis courts, swimming-pool, etc. Upon this site will also be erected a dining-room capable of accommodating one thousand employees at one time.

THE index to Volume 118 of this paper, covering the issues of the first half of the current year, is now ready for distribution. Those who want it should notify this office.

RESUMPTION of commerce with the recently belligerent countries of Europe should be expedited by the gentlemen at Washington if our foreign trade is to be restored without loss of time. We are informed that the French have re-established their canal traffic on 80% of the lines destroyed by the Germans. Night trains have been restored between France and Switzerland, and railroad service from Basle to Paris by way of Belfort has been resumed. Permits for transit from Switzerland to Antwerp and Holland by way of the west bank of the Rhine are being issued.

FAVORABLE action by the Senate Public Lands Committee on a bill for the leasing of Government oil-lands seems to forecast the adjustment of a public grievance that has created much ill feeling in the West. Included in the Bill are provisions by which persons having lawful claims for oil-land on the so-called naval reserves in California and Wyoming can proceed with development. Some of the litigation pending over disputed locations may be adjusted, and some of the restrictions that have interfered with development may be removed so as to expedite an expansion of productive activity. The Bill is much the same as the one that failed of passage in the last session of Congress. It looks as if it might go through this time.

OUR 'Discussion' department has been enriched lately by several notable contributions. In this issue we publish a letter from Mr. N. H. Emmons 2nd on the relation of organized labor to the engineering profession. 'Brains and Brawn' would epitomize the point at issue, but unfortunately the relationship is complicated by a *tertium quid,* namely Capital. We do not deny brains to Capital, for most capitalists became such by successful use of their brains, aided by opportunity, but the motive power of brains becomes subordinated to the mass momentum of money, so that the capitalist becomes the employer of brains and of brawn rather than the user of such of either as he himself possesses. Viewed in this way, the engineer comes between; he stands between the employer and the employee; as a professional man he cannot be hired in the common way; he directs the operations of Labor in behalf of Capital. Mr. Emmons discusses the subject from this angle and proceeds from it to a consideration of the use of authority in a democracy. Our readers will find his remarks mentally provocative; he is an engineer, he has been retained by capitalists, and he has employed labor on a large scale; so he writes understandingly.

REFERRING to the reform of patent procedure and of the Patent Office itself, as discussed in our issue of July 26, we are glad to note that remedial legislation, originated by the National Research Council and approved by the Engineering Council, has been started in Congress. Three bills have been introduced, known as H. R. 5011, a bill to make the Patent Office independent of the Department of the Interior or any other department, and to simplify the procedure of the Courts with reference to assessment of damages or profits for infringement of patents; H. R. 5012, a bill to establish a single Court of Patent Appeals; and H. R. 5013, a bill to increase the force and salaries in the Patent Office. Mr. Charles A. Terry, chairman of the Patents Committee, requests that representatives of Engineering Council write to their congressmen, urging the passage of these bills, and, so far as convenient, ask their friends to do likewise.

HENRY FORD'S damages of six cents—a nickel, plus war tax—against the Chicago 'Tribune', for libeling him by calling him an 'anarchist', recalls the famous suit between Whistler and Ruskin, in which the verdict for the plaintiff carried with it damages of one farthing. In 1878 a farthing had about the same purchasing power in London as six cents in Chicago today. John Ruskin, in 'Fors Clavigera', had criticized one of J. McNeill Whistler's paintings, and, among other things, had said: "I have seen, and heard, much of cockney impudence before now; but never expected to hear a coxcomb ask two hundred guineas for flinging a pot of paint in the public's face." In the course of the trial Whistler made his famous statement of the basis on which a professional man should be paid. He was asked how long it took him to paint a nocturne of Battersea Bridge for which he expected 200 guineas; he replied "about a day." "Only a day?" asked the cross-examining counsel. "Well, I won't be positive; I may have put a few more touches to it the next day . . . I had better say then, that I

was two days at work on it." "Oh, two days!" exclaimed counsel, "The labor of two days, then, is that for which you ask 200 guineas?" Whistler replied: "No; I ask it for the knowledge of a lifetime."

NO further supplies of arms and ammunition are to be exported from the United States into Mexico. This embargo went into effect on August 15. It is a great mistake to have permitted the exportation of rifles and cartridges into Mexico during the revolutionary period, for it has been a direct means of continuing both civil war and banditry. The dismissal of Mr. William Cummings, the British chargé d'archives, by President Carranza is another sign of the times. We hope that it may lead to joint action between England, France, and the United States in bringing the Mexican government to a realization of its international obligations. At the moment of going to press the capture of two American Army aviators is announced, with the statement that a ransom of $15,000 is demanded by the bandits into whose hands they have fallen. Events are moving to a new crisis, which this time, we hope, will lead to salutary action.

DURING the week the engineers of San Francisco have had an opportunity of meeting Mr. Van H. Manning, and they were glad to avail themselves of it. The Director of the U. S. Bureau of Mines won respect for his loyalty to his predecessor and former chief; he has proved that he can awaken similar loyalty in his own staff. During recent years, and particularly during the War, the Bureau of Mines has gained greatly in prestige and its Director has gained the goodwill of the mining public by his evident ability to make the Bureau helpful to those engaged in winning the metals from the crust of the earth. While in San Francisco Mr. Manning sounded a note of warning, pointing to the fact that the United States is consuming more oil than it is producing, so that the domestic output has to be aided by imports from foreign regions. Whereas we have used only 1% of our coal resources, we have already used 40% of our natural reserves of petroleum. Meanwhile England and Holland have gone to work to win control of oil supplies all over the world, notably in Mexico. It is not unlikely that the need of obtaining oil from Mexico will become an important factor in determining our policy toward Mexico, because the establishment of friendly relations would help greatly in assisting the legitimate participation of Americans in developing the Mexican oilfields. We quote Mr. Manning more fully on another page.

THE President is an eloquent speaker; he is famous as a maker of phrases; but as a writer of formal letters, of condolence or congratulation, he seems to have no better luck than the rest of us. His introductory phrase, 'May I not', has been worn to a frazzle, as his late distinguished opponent would say, even if it be defensible on literary grounds—which is doubtful. In his recent message of sympathy to Mrs. Carnegie he used it again, suggesting an obstinacy that must have survived the protests of his friends; for we feel sure that many of them must have remarked upon this idiosyncracy. The story is told that a journalist on the 'Olympic' catching sight of the 'George Washington', and knowing who was on board that famous ship, exclaimed: "There goes the 'George Washington', making 30 may-I-nots per hour." We venture to hope that ere long Mr. Wilson will find a less stereotyped phrase for beginning his official greetings of joy and sorrow. Speaking of Andrew Carnegie, we note that he is said to have desired his epitaph to be: "Here lies a man who knew how to enlist in his service better men than himself." This is not exactly what he said. In October 1904, on the occasion of a meeting in New York of the British Iron and Steel Institute, of which he was president that year, Carnegie made a speech, and in closing he expressed the hope that his epitaph might be: "Here lies a man who knew how to get around him cleverer men than himself." He waited for the applause, and it came. When hearing him express his modest wish, we thought it might have been phrased thus: "Here lies a man who knew how to get around cleverer men than himself," for we recalled the fact that he started his career as a money-maker by persuading Edgar Thomson, of the Pennsylvania Railroad Company, into granting him a quarter-cent rebate per pound of coke. On such shrewd beginnings are great fortunes built. Carnegie made Thomson famous by naming his steel works after him. However, there is this to be said, that Andrew Carnegie's epitaph acknowledges the spirit of co-operative effort by which big things are accomplished; it recognizes the fact that a man who plays a lone hand plays a losing game, and that the captain of industry will fail in achievement unless he can arouse the enthusiastic loyalty of his fellow-workers.

The Treaty and the Covenant

The applause that came from Mr. Lodge's followers in the gallery of the Senate and the jeers with which the same claque received the replies of those who countered his attack on the League of Nations will deceive nobody into the belief that the Senator from Massachusetts voices the preponderant sentiment of the country. It was an exhibition of bad manners; that is all. The subject is far too serious to be treated in this way. Neither the noisy demonstration in the public gallery of the Senate nor the bitter personal attacks on the President himself will suffice to mislead the bulk of thoughtful people in this country into a hasty repudiation of the agreements made by their representatives at Paris nor drive them into a refusal to ratify a compact that is the outcome of long and careful deliberation, and that in the end may prove to be the only means of amending a treaty the terms of which will need the interpretation of such an international court as the covenant of the League provides. Unfortunately the discussion of an international settlement of the affairs disrupted by the cataclysm of war is prejudiced today by the injection of political bias and personal animosity. The Covenant instead of being

regarded as a possible life-raft for the world's safety during storm has become a platform on which politicians hope to step to power. The personal reputation of Mr. Wilson is a small matter as compared with the success of an effort to end this war and to prevent more wars. The political ambitions of his opponents are even less important than the fame of the President if only the world at large, and this country in particular, can be guided wisely into an agreement likely to protect civilization from another assault of militant barbarism, from Germany or elsewhere. The preponderance of public opinion is this way, we believe. Straw votes and questionnaires all over the country indicate unmistakably that from 80 to 85% of Americans today are in favor of the ratification of the Covenant. They are right in their instinct to see the Treaty buttressed by the League. From the noisy claque in the Senate gallery we turn to the sadly wise and deeply serious statement made by General Jan Smuts at the time when he signed the Treaty of Peace under protest. General Smuts is not a European; he belongs to one of the democracies overseas; his point of view is sympathetic with ours in many respects; he has proved himself a gallant soldier and an able administrator; he is a man to whom we can give respectful hearing without losing any self-respect. To him the Treaty is not a satisfactory document, but he signed it because he realized that it was "imperatively necessary to end the war" and "nothing could be more fatal than the continuance of the state of suspense between war and peace." He believes that "the real work of making peace will only begin after this treaty has been signed, and a definite halt has thereby been called to the destructive passions that have been desolating Europe for nearly five years." He looks for a change of heart, for a spiritual revulsion that will evoke "a new spirit of generosity and humanity, born in the hearts of the people in this great hour of common suffering and sorrow." The Treaty, however, records two great achievements: "The one is the destruction of Prussian militarism; the other is the institution of the League of Nations." General Smuts is confident "that the League of Nations will yet prove the path of escape for Europe out of the ruin brought about by this war. But the League is as yet only a form. It still requires the quickening life which can only come from the active interest and vitalizing contact of the peoples themselves. The new creative spirit, which is once more moving among the peoples in their anguish, must fill the institution with life and with inspiration for the pacific ideals born of this war, and so convert it into a real instrument of progress." He concludes with these words: "Our Allied peoples must remember that God gave the overwhelming victory, victory far beyond their greatest dreams, not for selfish ends, not for financial or economic advantages, but for the attainment of the great human ideals for which our heroes gave their lives." These earnest words have been read with keen sympathy by many of our people, who, with millions in Europe, in Canada, and in Australia, as in France and Italy, see in the Treaty, with the Covenant, a hopeful approach to reason and justice. Both documents have defects; both contain clauses we would like to change; but no international agreement covering so complex a set of political conditions could be devised to please everybody; if we ask for changes, the other countries will ask for them also, and the whole controversy will be re-opened. The League is the ultimate reconciler of the difficulties growing out of the Treaty; the Covenant is elastic in many respects and is open to modification as circumstances arise. It is a movement toward the democracy of the nations and an attempt to establish a means of preventing the suicide of civilization. "It assumes," as Dr. Lyman Abbott has said, "that there exists in democratic peoples a real though imperfectly developed spirit of mutual trust and confidence." It has received the approval of the able and experienced statesmen of many countries, as well as of our own, and they have accepted its terms not without many surrenderings of minor points of difference. The controversy that was waged so long at Paris is being reproduced in a provincial way at Washington, complicated there not only by the larger issues of international rights but by the smaller incidence of domestic politics. Cannot our legislators make sacrifices of personal prejudice, even of national desires, for the sake of the great consummation for which the War was fought by the embattled democracies of the world? A few months ago as a people we took a solemn oath that so far as lay in our power we would prevent a repetition of the horrors of a world war. The barriers of time and space have been so conquered by man that any future war is likely to embroil all of us, as in the dark years just past. Have we so soon forgotten our stern resolve? There are millions of plain people who have not forgotten, and it is their impulsion that has compelled even the most fiery nationalists of the Old World to compromise with the demands of their diplomatic opponents in order to reach a practical result. Shall the New World show a smaller tolerance or a lesser generosity? Shall the dead go unrequited and all the suffering of the hideous years remain unrecompensed? Must the bitter lesson be learned again and mankind be exposed anew to another pentecost of calamity?

The Cost of Living

This is the all-absorbing subject today; and it is well that it should be engaging the attention of all earnest men, for the incidence of high prices on the necessaries of life is causing an irritation that may readily engender political unrest of a most dangerous kind. The world is in an ugly mood just now, for the lofty idealism and national solidarity of the critical days of a great war have been followed by bickerings among the allied belligerents and by jealousies among their peoples. An unlovely state of mind is discernible in the criticisms and detractions leveled by various nations against each other and in the eagerness shown by each to claim credit for what they did in behalf of their joint cause during the years of stress. Likewise the mass of the people, no

longer under the impulse of a high emotion, are inclined to growl at the cost of the War and are chagrined to find that the successful ending of it has had so little effect in lightening the personal burden of taxes and abnormal expenses. The Administration is wise in directing its best efforts toward the mitigation of conditions that if not intolerable at least have the effect of making the average citizen intolerant. The Attorney-General, who is named as a likely candidate for the Democratic nomination to the Presidency, is astute in taking a prominent part in the Government's campaign to stop profiteering and to investigate the reasons why it flourishes unchecked. In the latest issue of the 'Annalist' we find a plaint from a salaried professional man, who shows that he was more fortunate in 1914 when earning $2600 per annum than in 1918 when he earned $3244. He lives in New York. In 1914 he had no premonition that the killing of the Archduke at Serajevo would start events the effect of which would be to cut the value of his salary in half. In 1914 he saved $720; in 1918, only $359. A tabulation of the cost of meals shows that he breakfasted for 38½ cents in 1914, as against 70 cents in 1918. His dinner in the first year of the War cost 69½ cents, whereas in the last year it cost him $1.36. Such comparisons will be appreciated by the average professional man, especially by those in receipt of fixed salaries. When the man that plies the wheelbarrow from the concrete-mixer receives $6 per day, the hod-carrier $7, and the bricklayer $9 per day, in each case an increase of 100% since 1914, one feels sympathy for the university professor who has obtained no increment on his salary of $3300 per annum and for the Government geologist who is receiving the $3000 that he used to get five years ago. These are men of unusual ability and exceptional character, with years of experience behind them, yet their pay is only that of a skilled laborer. On the other hand, the younger professors and scientists receive anything from $1800 to $2500 per annum, which is about equal to that of the common laborer. It is a serious matter to a civilization such as ours when the very leaders of it are made impecunious, and when manual labor is able by truculent methods to assist itself so much more effectively as to win increases of wages that are denied to the gentler exponents of education. What is true of them is true in large measure of engineers; their salaries have been raised, but not so much proportionately as the wages of the men whose work they direct. They have fared better than the educators and scientists because they are closer to the classes whose collective bargaining has given them a whip-hand over the employer. If the engineers, among whom we include technicians generally, are unable to obtain just recognition from the corporations, it is not unlikely that in self-defence they will unionize themselves, a step that we would regret in so far as it might have the effect of diminishing personal initiative and individual efficiency. It must be realized that the persistent demands by labor for higher wages and for a voice in the administration of industry have become identified with the theory of a limitation of effort and the expectation of increasing the total employment. This is a most pernicious result and one that is largely responsible today for diminishing productivity. Mr. Herbert Hoover made this point in a recent published statement. At the same time he laid emphasis on the fact that the democratization of industry, which was rendered necessary during the War in order to obtain a maximum of co-operative effort, is now a real menace to the world, because it has caused a marked decrease of productivity since the stimulus of the War itself has been removed and has awakened dreams of gaining an easy living while diminishing the amount of personal effort among the workers. He warns us against the complacent assumption that the dominating financial position of the United States is an unmitigated benefit to this country, because the credits we are giving to the European countries are simply an advance against commodities in exchange, and credit will collapse unless such commodities are forthcoming; in short, if the credits are used for more than a temporary purpose, the effect of them will be to bring Europe under economic subjection to the United States and into a position so intolerable that the only escape ultimately would be war between Europe and this country. Here we suggest that the lending of huge sums of money to the Europeans wherewith they can buy American goods at inflated prices has the effect not only of over-burdening the countries lately at war, our own Allies included, but it enables the American producer to establish an export price that serves as an excuse for exorbitant prices at home. The mere threat of Government action has caused a drop in current prices of staple foodstuffs, and the inquisition started by the Attorney-General is putting the fear of the law into the hearts of the profiteers. But this will not suffice to lower the cost of living. It may be accentuated by profiteering, but it is due basically to the destruction of material and of labor by warfare; we have drawn millions from labor to soldiering, and even though they have doffed their uniforms they have not yet resumed their economic function as producers. Meanwhile the enrichment of this country, exaggerated by a superfluity of paper money, has incited an extravagance that is almost riotous in its exuberance. Sumptuary laws may be distasteful, and most of us are tired of restrictions upon our personal habits, but the time has come for the press and the pulpit to condemn and satirize the drunken spending of the vulgar rich, and to teach the simpler and saner ways of living that are consistent with the democratic ideal. Things are high in price because, among other reasons, people insist on having them and are willing to spend money freely in getting them. So long as everybody is willing to buy articles at fancy prices, the retailer can afford to share a handsome profit with the middleman. The manufacturer, in turn, can purchase his raw material at any price and pay higher wages with equanimity. It is a vicious circle of uneconomic blundering. Thrift, personal and national, accompanied by increased productivity, is the cure for the high cost of living.

Authority and Brains

The Editor:

Sir—Apropos of your editorial on 'The Engineer as a Citizen', appearing in your issue of July 5, I venture to submit the following:

While the War was in progress a certain poster was displayed throughout this country. It had the picture of a soldier and beside it the picture of a workman; underneath was an inscription something like this: "These two will win the War". There should have been a third picture showing 'Brains' set between these two, and the inscription should have read, "These three will win the War". It was not put there probably for the reason that Brains designed the picture and was modest, or else it was taken for granted that Brains would do all he could and did not need to be urged to give the best he had.

This picture is typical of the attitude of our Government officials and, in many cases, of our industrial corporations. Now, as between Capital on one side and Labor on the other, there is a group of persons who do the thinking, plan the operations, and see that the plans are carried out.

The first capitalistic class of any prominence in America was the thrifty New Englander. Among the first large ventures of capital were the American railroads. It was not possible for all the owners of any one corporation to assemble together and direct the operations of that corporation; instead, certain men were elected to represent the interests of groups of investors and these men, while they also were investors, became the paid representatives of capital and joined the ranks of the workers in that they received a remuneration for the work they did. They stand at the head of the class that represents the Brains of the operation. These men united together and employed others, and so on down through the line to the foremen and shift-bosses. These latter may be considered at the bottom of the ladder of brain-workers.

The success or failure of an undertaking in the great majority of cases depends, not on the natural advantages that are being capitalized, but on the brains that are directing the spending of the money. Different types of organization may accomplish the same successful end, but all must recognize that to be effective the organization must have authority delegated to the different members. This question of authority and where it is vested is the stumbling-block over which our industrial system seems to be having its greatest trouble just now. At one time it was considered that the man who was promoted from the ranks of labor to be a shift-boss, thereby lost his right to belong to the laboring classes. In those days a shift-boss had the authority to discharge a man under him. He might or might not have had the authority to employ, but the moment he was given the authority to discharge he lost his standing in the councils of labor. In other words, his judgment had been recognized and he had been taken into the ranks of Brains.

Why was there any need of shift-bosses anyway? When an enterprise grew to such a point that the foreman could not watch over all the work he had to have assistance. He needed men on whose judgment he could rely to see that the details of the work were carried out correctly and that the safety of the men was secured. In the more modern organizations it has been deemed wisest to take away the authority formerly given to the shift-boss, and now he cannot discharge men. This looks as though the shift-boss had not made good; but he is in good company, for the same authority has been taken away from foremen and even superintendents—and it is beginning to look as though managers, yes, and even presidents, did not have the authority to discharge men.

What has happened to cause this change? One answer is offered, which is, that organized labor through its influence over large groups of laborers has recognized that it could do better with men higher up than it could with foremen and shift-bosses, and so it has gradually moved up through the organization and now instead of going to the shift-bosses, it goes to the president, if he is willing to take away the authority of the manager, or to the manager if he interferes with the superintendent. Organized labor is now passing this stage and is going over the heads of all, to the highest authority in the country, the President. It will only be a short step to the head of the League of Nations. And yet there are a few of us left who believe that the old way was the right way and that the general should not give orders to the private direct.

It may be that the class called Brains is wrong, that it should not have any authority, but if this is a mistake, then after we have passed through a crisis of failures and terrible hardships, we shall start again with authority in its right place.

If all Labor unites then the only recourse is for Capital and Brains to unite. Germany might have won, and it looked as though she would have won, if the Allies had not united under one head. Germany typifies autocracy.

Our laboring men must be careful lest they find themselves backing an autocracy.

There is one way out; there may be several; there is the democratic system of having representatives of Labor meet representatives of Capital and of Brains, and then decide each case on its merits. These representatives should only represent the one enterprise in which they are interested; and the first meeting of such representatives must define and agree upon a system of organization; also they must define authority. When authority has been placed, then let Brains, Capital, and Labor respect that authority.

"No man can serve two masters" is as true today as it was when Christ said it nearly two thousand years ago. I was sitting in a small railroad station talking to the agent, who also acted as transmitter of messages for a telegraph company. He had just refused to accept my message. I asked him who ordered him not to accept telegrams and he replied that he had a letter from the president of the Order of Railway Telegraphers telling him not to accept any more until notified. I asked him for whom he was working. He replied the railroad company. I asked him if the railroad company had ever cancelled their instructions to him to accept messages. He replied they had not. I asked him if he realized that he was working for the United States government and disobeying orders by not accepting my message. He had not thought of that. I asked him if the railroad official who usually gave him orders instructed him to accept messages at his option. He did not believe such instructions would be given. Was he satisfied with his treatment by the railroad? He was. Did he know anything about the officials of the Order of Railway Telegraphers? He did not.

What more is there to ask?

There is something more vital to the difficulty, but it was not asked directly—although the answer was easily gathered from subsequent conversation. Did he want to strike? He did not. Would he strike? He might have to. Why? Because if he did not—well, he was afraid; he had a wife and dependents; something might happen.

Is this man living in a democratic world or in an autocratic world?

Who is he working for, the railroad company or the union?

Whose authority does he recognize, the United States government or the union official?

Let each man answer for himself which of the two masters he will serve.

This question of authority has been badly abused by the upper stratum of the class called Brains, and probably if the world but knew it, it is that part of our organization that has caused the banding together of the laborers into large unions. The directors of an organization usually are not familiar with working conditions and the actual touch between their representatives and labor. They have not passed sufficient authority from themselves to their representatives in the field, with the result that those representatives do not feel that they can decide without consultation higher up, and they "pass the buck". After a few such passes Labor feels that it is useless to treat on the ground and it also goes higher up. What has been the result? Those higher up decide one question and authority is broken down. Thereafter they must continue to decide. The mistake is made, they have broken down their organization, they have admitted a loss of confidence in their representative, and it cannot be expected that others will place confidence where they have none. The mistake of one such breach of authority makes it hard for many other enterprises that are working correctly. The man between is also often to blame, although it takes a strong man to say to those higher up, "Stop! you are breaking my authority." It is much easier to pass the buck than it is to fight out the problem and win or lose.

With authority must go the most important thing in our relations with one another and that is confidence. Authority should be given only to the extent covered by the confidence those having authority feel for the recipient of the authority. It is this lack of confidence that makes cowards of us all. Confidence comes only through close association with each other. Where there is confidence there is authority; without confidence, authority is a hollow staff.

Every man enjoys working with an organization where authority is definitely established, where each has confidence in the other, and where orders can be given and obeyed without question as to the whys and the wherefores. Every American likes to feel that there is a chance for him to reach a position of authority.

The important thing to remember is that we must respect authority both coming and going. It is easier to respect the authority coming from above than to respect the authority we have delegated to our subordinates.

The American laboring man has received the highest wages paid anywhere in the world. He had more independence than any other worker. He respected the authority of the Brains that led and directed his work. Let him halt and consider carefully which master he will serve. And let the employers of labor consider carefully whether they have given labor a square deal both in the wages they have paid and in the prices they have been and are exacting from the people for the product of the united efforts of Labor and Capital. Both must be brought to see that authority has been given Brains, and both must respect that authority.

N. H. Emmons 2nd.

Destrehan, Louisiana, July 20.

Concerning a Definition

The Editor:

Sir—"Which is the best, if one wants to be useful and to be really understood, to get one's words in the world, or to get them in the schools? I maintain that the good plan is to employ words in their popular sense rather than in their philosophical sense; and the better plan still, to employ them in their natural sense rather than

in their popular sense. By their natural sense, I mean, the popular and universal acceptation of them brought to that which in this is essential and invariable. To prove a thing by definition proves nothing, if the definition is purely philosophical; for such definitions bind only him who makes them. To prove a thing by definition, when the definition expresses the necessary, inevitable, and clear idea which the world at large attaches to the object, is, on the contrary, all in all."

So said Joubert, who was concerned with the French language as a medium for metaphysics, but with a lively recollection of the 'Ore' controversy, and in view of John Wiley & Sons' announcement, I respectfully disinter his words after a hundred years.

R. T. Hancock.

Jos, Northern Nigeria, June 10.

The Crowe Process

The Editor:

Sir—I am constrained to write a few remarks after reading the presidential address by Mr. Hugh K. Picard, delivered before the recent meeting of the Institution of Mining and Metallurgy, so liberally printed and commented on in your issue of July 5.

My initial point of criticism is found at his reference to the vacuum, or Crowe, process of de-aerifying pregnant cyanide solutions of gold and silver preparatory to the precipitation of their bullion content by means of zinc, either as dust or shaving. I do not controvert the utility of the process, because I believe in its efficacy. But I deny that it is a new discovery and a novel invention within the requirements of the patent laws of the United States of America. It has been stated that it is a belated discovery of an existing quality, and as such is entitled to recognition as original.

The basic principle, the process, and the apparatus have long been known and used in the same metallurgical line at many times and places by many people many years before application for a patent thereon. Hereinafter I will cite a number of them. The process is based upon the long and well-known fact that gold is not soluble in either potassium or sodium cyanide solutions unless free oxygen, as in air, be present in the solutions. Oxygen is an essential constituent of cyanide solutions used for dissolving gold from ores, and its absence is equally desirable when the dissolved gold is to be precipitated.

The reasons for the above-mentioned conditions are treated at length by me in a former paper.[1] They are also set forth in Crowe's paper on the process.[2] Discussion of the Crowe paper by J. V. N. Dorr, A. L. Blomfield, G. T. Hansen, G. M. Taylor, and G. H. Clevenger should also be read.[3] Various opinions were expressed.

In Julian and Smart's 'Cyaniding Gold and Silver Ores', second edition, 1907, on page 35, is an illustration and description of an apparatus for removing cyanide solution from ore-pulp that has been treated simultaneously separating air therefrom before passing to precipitation. On pages 56 and 57 of the same publication are descriptions of methods and apparatus used for filtering and, incidentally, removing air from cyanide solutions. Brunton patented in 1898 a filter for drawing solution from pulp, and air from the solution by the one operation. Various other filters having like operating qualities were invented long prior to 1916.

In April 1907, Mark R. Lamb described, in a paper[4] on the 'Cyanide Plant of the Combination Mines Co., Goldfield, Nevada,' shown by Fig. 7, an arrangement for taking air from a cyanide solution, while filtering, by using a dry-vacuum pump exhausting air from a vacuum-chamber through which the solution is drawn from the filters, and discharged by the suction of a barometric pipe.

In March 1919, Tweedy and Beals described[5] apparatus used at the Minas del Tajo, Sinaloa, Mexico, in words as follows: "The air and solution from the sections go to a chamber that is connected to the wet and dry-vacuum pumps. Here the solution and air are separated, the wet-vacuum pump being connected to the base of the chamber, and the dry-vacuum pump to the top."

In October 1911, in a paper by Charles A. Chase, entitled 'Notes on Liberty Bell Mine, Colorado', he remarks.[6] "The greatest single improvement in this plant was the change from the common wet-vacuum pumps to a combined dry and wet-vacuum system, in which all entrained air is taken out of the upper end by a dry-vacuum pump, and all solution at the lower end by centrifugal pumps. The diagram, Fig. 12, shows the arrangement."

In September 1915, in an article describing the mill at Wonder, Nevada, E. E. Carpenter said: "A dry-vacuum is used and the solution removed from the receiver between the filters and the dry-vacuum pump by a small triplex pump." He further said that this equipment saved 0.23 lb. of cyanide per ton. But he ascribed this saving to other items than the removal of air.

No doubt more extended investigation would find more of such anticipations. In the arts means of separating air, or gases, from liquids have been known and used for many years.

In view of the foregoing it may be asked: Why were claims such as the following sample ones granted by the U. S. Patent Office[8] on an application filed July 3, 1916?

"4. The process of precipitating material from its solution which consists in subjecting the solution to a vacuum and precipitating the material from the solution.

"14. In an apparatus for precipitating material from its solution, a closed chamber receiving the solution, and

[1]'Effect of Air in Cyanidation', by N. S. Keith, Eng. & Min. Jour, March 22, 1919.

[2]'Effect of Oxygen upon Precipitation of Metals from Cyanide Solutions,' Bulletin, August 1918, A. I. M. E., page 1279.

[3]Bulletin No. 143, November 1918, A. I. M. E., page 1667.

[4]Trans. A. I. M. E., Vol. 38, p. 207.

[5]Trans. A. I. M. E., Vol. 41, p. 353.

[6]Trans. A. I. M. E., Vol. 42, p. 729.

[7]Trans. A. I. M. E., Vol. 51, p. 133.

[8]U. S. patent, No. 1,281,249, October 8, 1918.

means for creating a vacuum in said chamber to remove from the solution gases which interfere with precipitation.

"2. The process of precipitating valuable metal from metal bearing cyanide solutions which consists in removing from the solution gases which interfere with precipitation and subsequently precipitating the valuable metal therefrom by flowing the solution in contact with a metal capable of precipitating the valuable metal from solution."

The above are three in 31, wherein an ingenious patent solicitor 'rings all the changes' he can devise in making combinations of details, essential and otherwise. Permutation is the arithmetical term.

The answer, in part, is made plain by reciting the following incident: Some time ago, while engaged as an expert for the defendant in a suit for alleged infringement of a patent for a process of cyanidation of gold and silver ores, and while engaged in investigating the prior state of the art, I found in the library of the Patent Office a book descriptive of the art involved, and published some three years before the date of the application for patent, a full description of the method covered by the patent in suit. When I brought this to the attention of the Examiner who passed upon the application for the patent, he said that if he had known the prior state of the art as shown in the book the patent would not have been granted. In justification of his position he further said that the practice in examination was confined to consideration of the patents that had previously been issued by the United States, Great Britain, France, and Germany, without reference to the technical publications in the art involved. This procedure was caused by the limited number of examiners and officials, which limitations were due to the paucity of appropriations made by Congress for sustaining the business of the Patent Office; coupled with the presumption that such prior discoveries and inventions had been patented in at least one of those countries. The suit was lost by the complainant. Many thousands of dollars were thus unnecessarily expended by both parties to the suit.

On March 14, 1895, I read in London a paper[9] relating to cyanidation. Among the six persons who took part in the discussion were Hugh K. Picard and J. Swinburne.

Mr. Swinburne remarked (quite apropos to the present claim that Mr. Crowe was the first to recognize the deleterious presence of air): "We have to compare two methods. In one, zinc shavings are used to deposit the gold by simple substitution. This seems simple, but we are told that the solution of zinc, and, with it, the consumption of cyanide is excessive. I would suggest that this extra consumption is due to access of air, or dissolved oxygen, and might be prevented."

Mr. Picard stated his belief that cyanate of potassium is a solvent of gold; but was corrected in that belief by Mr. Swinburne.

[9]'Electrolysis of Gold,' Jour. Proc. Inst. Elec. Eng., Part 117, Vol. 24, p. 236, 1895.

Mr. Picard 'boosted' the use of bromine in cyanidation in language as follows: "I think the term 'cyanicide' is used wrongly. If Dr. Keith had been fully acquainted with the recent researches of Mr. Sulman on the action of bromine he would not have called bromine a cyanicide."

Dr. Keith replied: "Though not 'fully acquainted' with the researches of Mr. Sulman on the action of bromine, I know enough of it to reiterate my belief as stated."

It is not necessary to state which party was right, as subsequently developed in practice of the art.

The art of cyanidation was born in empiricism, and empiricism has pervaded it, though in lessening and lessening degrees, to the present day. In that respect it has not differed in kind from various other arts and derived sciences. Modern chemistry is like growth from ancient alchemy. In the growth of the art many kinds of apparatus and methods of using them were devised, experimented with, operated, and then discarded for others; not always holding fast to that which was good. Suitable recognition was frequently given to effective methods and apparatus, and other applications were also lauded, and then abandoned for some new fancy, without arriving at any settled judgment. To err is human. We have all erred, and the best we can now do is to acknowledge our errors, plead imperfect knowledge at the crucial time, and promise to do better as fast as we learn how so to do. For the general good, both of laity and profession, error should be pointed out, though not in a captious spirit. Hence the foregoing.

N. S. Keith.

Philadelphia, July 14.

[In accord with our policy of giving free scope to criticism in technical affairs, we print this letter from Dr. Keith, but we do not find ourselves in agreement with his contentions. The general idea of de-aerifying cyanide solutions preparatory to precipitating their gold and silver contents may have been recognized vaguely in the literature of the subject but the application of the idea to milling practice, specifically by removal of the dissolved oxygen by means of a vacuum, is quite another matter. Dr. Keith quotes a number of metallurgists, all of whom took part in a public discussion of the Crowe process in 1918, whereas the application for patent was made by Mr. Crowe on July 3, 1916, as is shown in the copy of the patent which Dr. Keith was good enough to send to us. Professor Clevenger, in the discussion before the Institute, stated that the Crowe process was "a distinct new development in cyanidation." He added: "After reading the paper, it occurred to me that some of us had done practically the same thing some time ago but without design and unconsciously." Very likely; lots of ideas wander disconsolately in our craniums just because we fail to co-ordinate them with other ideas so as to obtain concrete results. We note in the latest annual report of the United Eastern Mining Co. that "a decrease of nearly 50% in the consumption of zinc-dust" is being

made by use of the Crowe process, we understand also that this company, together with others, has caused a careful search to be made into the patent records before entering into a contract for the use of the process on a royalty basis. Dr. Keith's criticism will be noted in due course by the legal advisers of other companies and they will ascertain for themselves whether his contentions are well founded or not. While we agree in the main with our correspondent as to the defects of our patent system and the deficiencies of the staff at the Patent Office, as will be found by referring to the editorial on this subject in our issue of July 26, nevertheless we are not disposed to fight every patentee in order to prevent him from being rewarded for his ingenuity; and we trust that our fight against Minerals Separation is not so interpreted. We do oppose excessive royalties, tyrannic imposition, and crude attempts to exercise monopolistic control; that is far different from opposing the bestowal of a reward on successful inventiveness in the arts of mining and metallurgy.—Editor.]

War Minerals Relief

The Editor:

Sir—Commendation is in order because of your expressions in the issue of August 2, relative to War Minerals Relief and the ruling of the Attorney-General.

The questionnaire issued under the provisions of the Relief Bill included this query: "What induced claimant to undertake the production of any of the above mentioned minerals?" To this inquiry doubtless many varied replies were made. Some claimants possibly were led by their patriotism alone, others by a combination of desires, in which the financial admittedly was not the least; but in any case the scale was tipped by the fact of the Government's established prices for these war minerals. If these prices were not public notice, request, and invitation, what were they—an attempt to deceive?

You say personal request or demand by the Government was not possible, in all cases. That may be, but what about the personal request or demand verbally by the Government, through its officials, such as those of the Bureau of Mines and Geological Survey, chief or subordinate, it matters not which, Government officials in either case?

Dwight E. Woodbridge.

Duluth, August 7.

The Quicksilver Industry

The Editor:

Sir—In your issue of August 2, Mr. William Forstner calls attention to a contribution made to the 'Engineering & Mining Journal' by the undersigned "endorsing the policy of leaving the quicksilver industry unprotected".

Quite to the contrary, I should like to see this industry protected to such an extent as to make it one of the prominent metal industries of the country. The article referred to was written with the hope that it might draw out stronger arguments for protection from those intimately acquainted with the industry than had yet been presented. Mr. Forstner's further remarks are in line with this hope. There is, however, one point of very considerable importance that has not been contradicted satisfactorily but should be in order that the protectionists' position may be made strong.

In the various official reports that have appeared stress is laid upon the fact that the grade of ore treated in this country has been, for several years, growing lower and lower with no hope of improvement in this direction. That consequently the industry is a declining one which no reasonable protection will bring into activity again, and it may be expected that instead of any permanent or gradually diminishing protection being adequate it will be necessary to continually increase this protection. If those who are personally acquainted with the quicksilver resources of this country can refute this assertion with proof of the existence of substantial supplies of commercial ore they will add one very substantial argument for the protection desired.

F. F. Sharpless.

New York, August 8.

Tests of the heating values of fuels have become of great commercial importance, as practically all coal sold on large contracts is paid for on the basis of the heating value found in the tests conducted by or for the purchaser. The instrument used for carrying out this test is the bomb calorimeter, which comprises a strong steel cartridge or capsule with removable cover, adapted to contain a small charge (about 1/30 ounce) of coal. The bomb is tightly closed and oxygen is introduced under high pressure. It is then put into a vessel containing a measured quantity of water and the coal ignited electrically, the heat generated being absorbed by the water. The quantity of heat liberated in the combustion of the fuel is then calculated from the rise in temperature of the water. Important aid has been given in the standardization of the testing of coal for calorific power by the issuance by the Bureau of Standards of samples of materials with accurately known heat values, which afford a simple, precise, and convenient means by which the user of the calorimeter may check up the accuracy of his own determinations.

A recent dispatch from Ottawa gives the details of proposed legislation providing for Federal aid to technical education in Canada. According to the terms of the bill, which is sponsored by Hon. J. A. Calder, Minister of Immigration and Colonization, annual grants from the Federal government are to be made to the several provinces on a population basis and are to be applied to purposes of technical education by the provincial authorities. The terms of the bill provide for Federal approval of provincial plans for the utilization of annual grants and it may be hoped that recommendations of established Canadian technical societies will receive due consideration when plans are being developed for the extension of technical education under the proposed legislation.

The Mining Department of the A. E. F. University

In the group of schools established by the Y. M. C. A. at Beaune and corresponding somewhat to the Khaki University of Canada, the mining department was by no means large. The fifty odd students were a mere handful compared with the regiment interested in gas-engines and automobiles, but the quality of the students was high. The faculty included Dr. A. C. Lane, recently chairman of the Boston section of the A. I. M. E., and Capt. H. C. Ray, of the University of Pittsburgh, both of whom are as well known in America among scientific men as among mining men. The teaching work of the officers detailed, often against their wish, for the purpose was good. Among them we may mention Capt. Hugh Archbald, of Scranton, one-time editor of the 'Colliery Engineer', a graduate of Yale and Columbia, Capt. H. C. Vail, Capt. E. C. Dietrich, Corporal J. E. Rypinski, another Columbia graduate. Textbooks and apparatus were scantily supplied during the brief three months of the school's existence, so that the teachers had to emphasize their personal experience.

MINERALOGY CLASS AT WORK

Fortunately, however, the French generously loaned minerals and rocks enough to give the instruction in these lines a practical character. Surveying instruments were available, so that mine-surveying could be taught. The gypsum mine at St. Gilles near-by was used by Capt. Dietrich's class in mine-surveying. Beaune was well situated to supplement the work of the classroom by practical outdoor work. Students on leaving were able to say that they had got much from the courses and this was due probably largely to these trips. The students were received with every courtesy at the great plant of the Schneiders at Creusot. They had a chance to see the complete plant of the Epinac coal mines, involving a coal-washer, a briquetting plant, and a central power-plant, and to go underground and see the French system of mining thick seams. They saw something of the oil-shale that is mined and distilled around Autun. Another beautiful and interesting trip was to the mine of fluorite at La Petite Verrière, on the invitation of the owner, M. P. de Champeaux. The beautiful greens and purples of fluorite made an attractive dump. Mines of iron ore near Nolay, not now working, were also visited.

Besides these mines, there were numerous quarries and exposures near-by, where one could see phosphate and chert nodules, collect fossils, study replacement of oölite by iron ore, and get the idea of the structure by which the citizens of Beaune, situated on the Pliocene top of a down-faulted rift-block near the margin, can see the Jurassic escarpment of the Côte d'Or dominating their town, while a short distance westward, the Paleozoic and the granitic massif of the Morvan is brought to the surface.

Accordingly, before the term ended a museum of specimens, including all the important classes of rock, from basalt to granite, from quartzite and gneiss to shale and limestone, and most of the common minerals, had been collected by the students themselves on the various excursions.

INVESTIGATIONS in South Lapland seem to show that valuable copper veins have been found, especially in the upper part of the Vilhelmina district (Dikanar and Farmomakke, although at present there is no information as to their richness.

J. E. RYPINSKI, H. C. RAY, A. C. LANE, E. C. DIETRICH, HUGH ARCHIBALD

THE MINING COLLECTION OF THE A. E. F. UNIVERSITY

An Unusual Apex Case

By R. T. WALKER

With all its truitage of waste and obstruction, litigation and blackmail, the apex law has been productive of some good which otherwise might not have been accomplished, in the fact that the development work which has been done to clear up disputed points has not infrequently led to the discovery of previously unsuspected orebodies, and that much advance in geologic knowledge has resulted from the close study made of veins and lodes in connection with mining litigation. An instance in point is the contest between the Square Deal Mining Co. and the Colomo Mining Co., in Gilpin county, Colorado, which, because of a rather unusual type of vein structure disclosed and because of the light it sheds on ore deposition, merits more than local celebrity. The circumstance that one of the litigants was dispossessed of its most important orebody by the other in one suit, but recovered it in a subsequent action—foiling the villain in the last act, as it were—lends a melodramatic touch to the story.

The vein structure and the relative positions of the Notaway claim of the Square Deal Mining Co. and the Sub-treasury claim of the Colomo Mining Co. are indicated on the accompanying cross-section. The Notaway and Cecil veins are approximately parallel in strike, but dip toward each other at the surface. The Notaway vein, which showed bunches of rich gold ore in its outcrop, was located in 1868, and has been worked almost continuously ever since. The outcrop of the Cecil vein is barren, for which reason its location and development were not undertaken until much later. The main shaft on the Notaway vein followed the North Notaway vein below the 250-ft. level (marked *X*), without the departure of the South Notaway vein at this point or the crossing of the Cecil vein a few feet lower having been observed. It had, indeed, been noted that the rich gold-quartz ore, which made mining operations on the Notaway vein profitable above the 250-ft. level, terminated at this point, but this was interpreted simply as the ordinary bottoming of an ore-shoot, and exploration was continued in the low-grade ore of the North Notaway vein below in the hope of encountering another similar ore-shoot at greater depth. The South Notaway vein was not discovered until 1894, and then through accident. A second shaft having been sunk on the Notaway vein, it was desired to connect it with the main shaft by a drift along the vein. The second shaft, however, had unwittingly followed the South Notaway vein below the point of juncture, and as the connecting drift was started below this point, it followed the South Notaway vein and failed to connect with the Notaway main shaft. The true situation being disclosed by a survey, a cross-cut completed the connection and demonstrated the division of the vein below the 250-ft. level. The rich ore, which had induced the exploitation of the Notaway vein, and which had disappeared from the Notaway shaft at the 250-ft. level, was now found to continue from that point down the south branch of the Notaway vein, and this branch of the vein was developed and worked down to the 950-ft. level.

Meanwhile the Colomo Mining Co., doubtless encouraged by the similarity of the dip of the upper part of the South Notaway vein with that of the Cecil vein, and believing in the identity of the two veins, sank a shaft on the Cecil vein and in 1914 broke into the Notaway workings, effecting a connection with the South Notaway vein at the point *Y*.

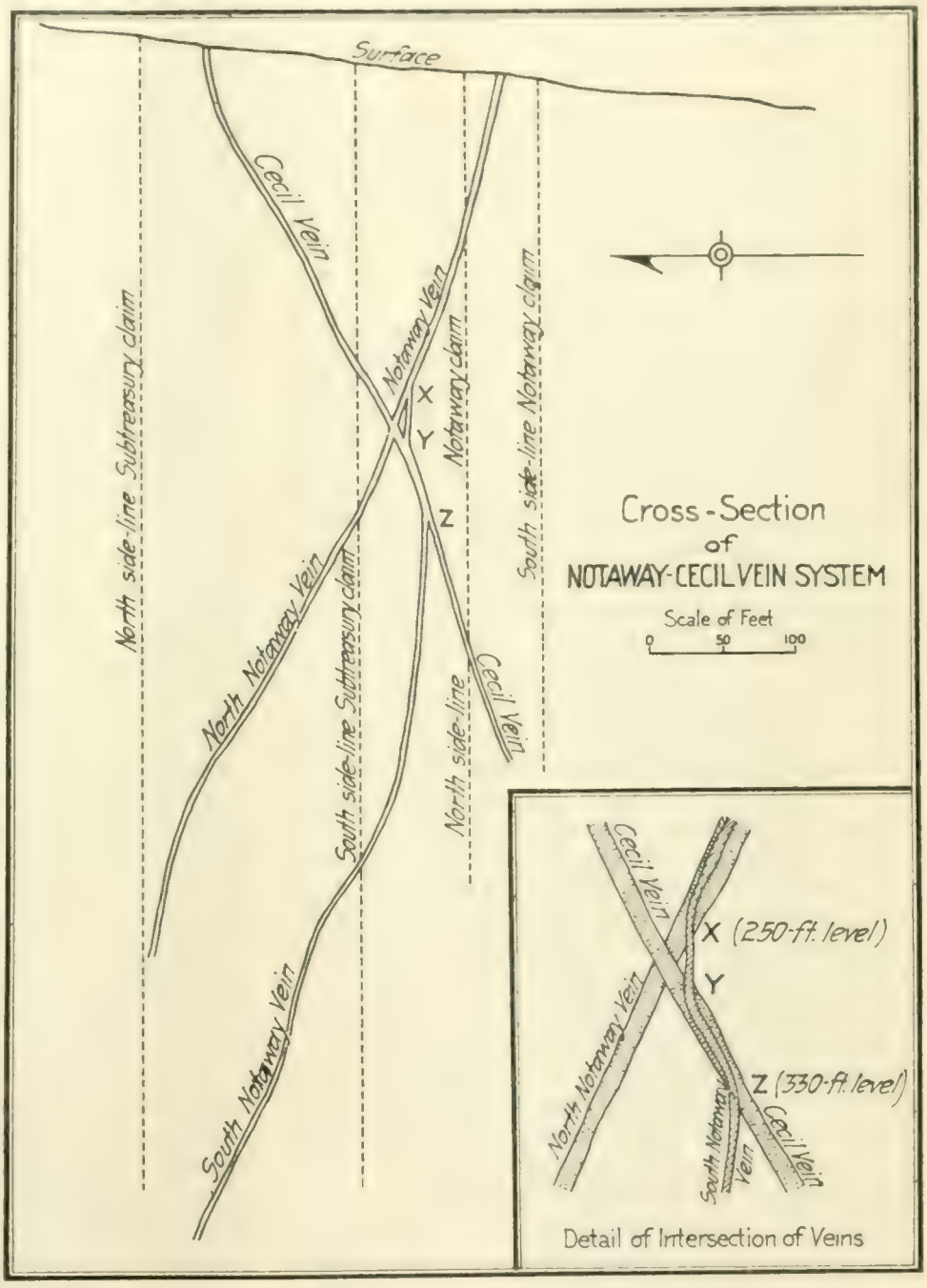
Litigation between the two companies, to determine title to the South Notaway vein, followed immediately. The Square Deal Mining Co. attempted to show that the South Notaway vein differed materially in character of mineralization from the Cecil vein, but its defence was fatally defective in not supplying proof of any alternative course for the Cecil vein (the continuation of the Cecil vein below the point *Z* not having as yet been discovered); therefore the Court's decision was rendered in favor of the Colomo Mining Co., which thereupon entered into possession of the South Notaway vein, and mined a considerable amount of ore from it during the following two years.

In the meantime a mortgage on the property of the Square Deal Mining Co. was foreclosed, and the mortgagee took over the property in satisfaction of the judgment. The new owner, being dissatisfied with the results of the previous suit, and being at liberty to re-open the case through not having been made a party thereto previously, filed a new suit against the Colomo Mining Co. and obtained a court order permitting exploration in the vicinity of the South Notaway vein, in the course of which a cross-cut driven southward from the South Notaway vein at a level shortly below the point *Z* cut the extension of the Cecil vein below that point, and thus supplied the missing key to the enigma.

In the trial that followed it was proved that the Cecil vein, both above the point *Y* and below the point *Z*, was mineralized only with pyrite and was barren of value, having yielded no commercial ore whatsoever. The North Notaway vein below the point *X* was shown also to be mineralized chiefly with pyrite, resembling the Cecil vein in this respect, but differing from it in that the North Notaway vein did have some value in the precious

*The information on which this article is based was supplied by Charles H. Haines, of Denver, counsel for the plaintiff in the second suit.

metals. The South Notaway vein differed materially from the other two, as it contained a more or less continuous quartz seam, with which the gold that rendered this vein commercial was chiefly associated. This distinctive quartz seam accompanied the Cecil vein from the point Z to the point Y, where it broke across the angle between the two other veins at a distance of a few feet from their intersection, and, entering the North Notaway vein at the point X followed it thence to the surface. The conclusion drawn from the facts thus established was that there were present three distinct veins, formed at separate periods. The North Notaway vein was the oldest, as the Cecil vein broke squarely across it at the point of intersection. The Cecil vein was formed next, and probably after no great interval of time, as the similarity of the mineralization of the North Notaway vein had been effected. The South Notaway vein, while originating independently and maintaining a separate existence in depth, had evidently been deflected from its course on encountering the Cecil vein at the point Z, following and reopening that vein to the point Y, where the similarity of the course of the North Notaway vein with the direction of stress causing the formation of the South Notaway vein, as indicated by the approximate parallelism of the two veins below the point Z, again deflected it, so that it followed and re-opened the North Notaway vein from the point X at least as far as the present surface. The deposition of the distinctive and characteristic quartz seam with its accompanying gold followed, thus supplying the clue that now permits the identification of this youngest vein where it accompanies its older brethren.



From the surface to the point X, therefore, the Notaway vein is a compound vein, consisting of the North Notaway vein and the South Notaway vein, and displaying the mineralization characteristic of both; while from the point Y to the point Z the Cecil vein is a compound vein, consisting of the Cecil vein and the South Notaway vein and showing the mineralization characteristic of both. Corroborative evidence is found in the circumstance that the quartz seam is accompanied along its south wall by a post-mineral slip, which follows it around the curve between the Notaway and Cecil veins. That a post-mineral slip, tending to follow the line of least resistance, should deviate so markedly from a straight course suggests strongly that the quartz seam is to be considered as an entity separate and distinct from the Cecil and North Notaway veins, and that it occupies the latest prior fissuring and therefore the one most readily re-opened by post-mineral stresses.

On the basis of this evidence, the new owner of the Square Deal Mining Co.'s property claimed that the South Notaway vein, although following for some distance the courses of the North Notaway and the Cecil veins in the upper part of its course, continued to be a separate entity, definitely maintaining its identity; that,

in common with the North Notaway vein, it apexed within the boundaries on the Notaway claim; and that, consequently, title to the South Notaway vein from its juncture with the North Notaway vein at *X* and including the portion between *Y* and *Z*, where it had a course in common with the Cecil vein, appertained to the Notaway claim, which was the senior location. The decision of the Court affirmed this contention and returned to the Notaway claim, after two years alienation, the vein and orebodies that, through the industry and at the expense of its previous owners, had been discovered and developed.

Conclusions may be drawn from this case, both as to the operation of the apex law, and for application to practical mining. While this seems to be an instance where law and equity coincided—a condition that unfortunately has failed to prevail in much of the apex litigation—it well illustrates the difficulty of applying to a problem of even but moderate geologic complexity a law which apparently was founded on a narrow and largely erroneous conception of the origin and nature of ore deposits; and it serves to show how much unnecessary expense, with consequent detriment to legitimate mining operations, may be caused by this law, and how much simpler, with equal effectiveness in rewarding the discoverer of a vein, would be the substitution of vertical boundaries for the present extra-lateral right, after making proper allowance for the lateral departure of orebodies on the dip of the vein by increasing claim-widths or providing for the location of flanking claims to cover the dip.

This case also affords a lesson as to the importance of careful investigation into the genesis of ore deposits. Too often is it assumed that the contents of a vein have been deposited synchronously, or, even when more than one period of deposition is recognized, that simple reopening of the same fissure is sufficient explanation. Investigation may develop many similar cases where the re-opening of a portion of the course of a vein, through the formation of a later vein, which elsewhere maintains a separate identity, has caused the overlap of two distinct periods of mineralization in the common channel; and this case suggests that, where one or more valuable constituents of an ore-shoot terminate abruptly, it may well prove worth while to investigate whether a productive vein—perhaps concealed behind a slickensided post-mineral slip, which so often masquerades as a 'wall'—may not be departing at that point.

THE BLACK HILLS mining district of South Dakota produced $6,565,209 in gold and 159,246 ounces of silver in 1918. From January 1, 1918, to October 27, 1918, the Homestake mine and mills were operated at full capacity, but during the remainder of the year the property was operated at only 71% of capacity. This property, which produces the bulk of the output of South Dakota, had not reached full capacity in June 1919. The Golden Reward mines and mill, closed in 1918, have not resumed operations.

Decreased Output of Gold in Australia

The decline in the gold-mining industry of Australia has become one of the most pressing problems of the Government, which is in constant receipt of petitions for the relief of the industry, and a movement for the granting of a subsidy of £1 per ounce on gold produced has grown formidable. Other proposals include the 'grubstaking' of returned soldiers to prospect the unexplored central and northern portions of the Commonwealth's territory, and Government loans to mining companies. The chief argument of the advocates of a bounty or subsidy and the retention of Government restrictions is based upon the great amount of paper money in circulation, approximately $300,000,000, against which is held a reserve of only a little over $100,000,000 in gold. The national notes act of 1910 stipulates that all notes issued above £7,000,000 shall be balanced by gold pound for pound. The legal reserve on notes up to £7,000,000 is 25%. Many financiers believe that the Government should continue its control of the gold market until the notes issued above £7,000,000 are covered by 100% gold, as required by the law of 1910. The decline in the production of Australian gold is shown in the following table, giving the production since 1899:

Year	Value	Year	Value
1899	$70,631,303	1909	$61,290,271
1900	65,844,324	1910	56,180,822
1901	70,473,557	1911	51,980,441
1902	71,986,062	1912	48,001,198
1903	79,192,164	1913	45,559,622
1904	76,991,084	1914	40,240,552
1905	75,577,422	1915	40,193,847
1906	71,184,283	1916	34,382,910
1907	65,699,472	1917	30,050,220
1908	63,479,862		

The year 1903 was a record one for gold production, with a yield valued at $79,192,164, from which time the production has been steadily declining until in 1917 it was less than 40% of the 1903 record. In 10 months of 1918 the production of the Commonwealth, exclusive of the Northern Territory, was only $22,163,700. Increased cost of production, Government restriction, and the great number of skilled miners who were in the War have been given as the chief reasons for the decline in production. The director general of Geological Survey, Victoria, at a conference of gold producers in January, 1919, stated that he was quite certain that gold in Victoria was by no means exhausted. He stated that there was not a mine working in Ballarat East, but that though the mines in that field had been worked for 60 years they had not reached to a third of the depth of the Kalgoorlie mines. The conditions of mining have simply been against the industry. The president of the Tyrconnel Gold Mining Co., Queensland, at the same conference stated that there was a great belt in Queensland still undeveloped, but that with existing high cost of production and restricted market for the product there was no hope of developing it. One speaker stated that unless the miners adopted a more sympathetic attitude toward the mining companies of North Queensland the mines would be forced to shut down.

A Metallurgical Journey to Shasta, California—IV

The Bully Hill Mines. Reverberatory Practice. Treatment of the Zinc in Copper Ores. The Bag-Houses at Mammoth. Sprague Process.

By HERBERT LANG

The district around Bully Hill bears a close likeness to that of the Afterthought, in the manner of ore occurrence and general geology. It is now about 60 years since the first discoveries were made in that camp, years during which all the ups and downs of mining life were experienced. Activity at first centred upon certain placers of limited extent, but rich enough to draw attention from outside. After this the silver ores about Copper City, the distributing point of the locality, were uncovered, and for a number of years, up to 1880, a considerable production of that metal was made. As at Afterthought, a silver mill was erected, and with the same results, namely, some measure of success while the richer surface ores were being worked, but an entire cessation of operations when, the mines having gone deeper, the underlying sulphides alone were left. The Bully Hill-Copper City mines, however, proved more productive than those of Afterthought, and work went on for a longer time, and with better financial results. No trustworthy information is to be had concerning the output, but it is loosely asserted that a million dollars was drawn from these mines before the year 1880, and this may well have been the case. The little stamp-mill through which the ore, or the greater part of it, passed still stands on its old site near Copper City, a relic of by-gone days. After that date a period of inactivity supervened until along in the 'nineties, when, owing to the success of the Mountain Copper Co., at Iron Mountain near-by, renewed interest began to be shown, and it was realized that the old camp possessed valuable reserves of ore not dissimilar from those being worked at Keswick. James Sallee was the pioneer in these operations, as he had been at Iron Mountain; for, having relieved himself from his entanglements there, and knowing something of the conditions at Bully Hill, he proceeded to develop certain claims, with excellent results. Mr. Sallee was chiefly a promoter, and in that capacity he endeavored to enlist Californian capital in his new undertaking, but without success. His theme was the copper ore which he had found in abundance in the old Bully Hill claim; but to this the wiseacres of San Francisco turned a deaf ear, as was their wont when the red metal was mentioned. They harked back to the days when men went broke in copper in the times succeeding the Civil War, and refused to invest a cent in California's copper mines. Three years of struggle and Sallee sold his interest to Capt. J. R. De Lamar, a famous mine-operator, deceased in 1918. The consideration, practically in cash, was $225,000, whereby Sallee realized a comfortable and well deserved fortune.

Under De Lamar's energetic direction the district entered upon an era of activity, the gross output running into the millions. After the opening of the Bully Hill mine, the erection of a smelting works followed and a steady stream of blister copper went forward to the refinery at Chrome, in New Jersey, during the five years of De Lamar's ownership. Smelting began on the enriched ores of the upper parts of the mine, the grade falling off as depth was gained and the unaltered sulphides came in. While the ore at first carried as much as 15% copper, with a more than proportionate amount of gold and silver, the average ore smelted during the De Lamar management could not have exceeded 5%, with four or five dollars in precious metals. The bullion might have contained $100 in the precious metals, but probably somewhat less, although it was no doubt the richest smelted product ever sent from Shasta county.

In the course of time, while the ore was becoming poorer, another source of difficulty arose in the shape of the fume question, which has proved such a drawback to every smelter throughout the country. With wise foresight the Captain made haste to dispose of his property, selling it in 1905 to the General Electric Co., of New York, at a price understood to have been $1,250,000. The smelting works then included a blast-furnace with a daily capacity of about 150 tons; a converter plant of corresponding magnitude; a battery of 60 roasting-stalls working through an imposing brick smokestack; 2 McDougall calciners of moderate size, together with such accessories as an electric crane and briquetting machinery—in short, a complete plant and the second in age and the fourth in size and cost among the five considerable plants erected in Shasta county. The plan was from the first to produce blister copper in bars for shipment, instead of, like the Mountain Copper Co., making matte only, to be converted into copper elsewhere.

For a time after the accession of the General Electric Co. the mines, the Rising Star in particular, was the scene of energetic development, after which the smelting works were enlarged and smelting resumed. The railway, styled the Sacramento Valley & Eastern, was completed from Pit, a station on the Southern Pacific, to Bully

Hill, a distance of 14 miles, at a cost of $650,000. Certain additions to the smelter brought its daily duty up to 350 tons, but during the dozen years of the Electric Company's ownership hardly 50,000 tons of ore was smelted. The total amount treated during both managements reached 417,671 tons, of which 220,946 tons was derived from the Bully Hill mine, 174,869 from the Rising Star, and 16,856 from the Copper City mine. The average extraction was: copper, 4.24%; gold, 0.085 oz.; and silver, 4.20 oz. per ton. The total metal product, shipped in the form of copper bullion, amounted to 34,413,596 lb. copper, reckoned at 13c. per pound, making $4,473,767.48; 34,554 oz. gold at $20, worth $691,080; and 1,707,875 oz. silver worth, at 50c. per oz., $853,937.50. The whole output reached the respectable sum of $6,018,784.98.

The works closed on June 30, 1910, when 400 men were laid off, and the locality lapsed into quietude for some years.

The General Electric Co., although it had provided itself with an enlarged smelting works, adopted the plan of shipping the matte, instead of converting it, dispatching the greater part to the Mammoth works at Kennett after that establishment came into existence. Among the innovations introduced at Bully Hill was a reverberatory smelting furnace. It was of modest dimensions, measuring 35 ft. by 16 in the hearth, and is of some interest by reason of an exceptional feature: it was so arranged that the blast of the cupola near-by was heated by the chimney gases, which pass off, as all must know, at a high temperature. It is the prevailing custom nowadays to utilize these hot gases for heating steam-boilers, and many new plants in the United States are so designed. Previously it had been the custom to let the gases go to waste, thereby incurring great loss, since of the total heat generated in that kind of furnace quite one-half escapes through the flue. By introducing a boiler in the path of the gas, this heat, or a good part of it, is recovered in the form of steam, and the power thus saved is usually sufficient to run the whole works. But the Bully Hill plant, being driven by electricity generated by water-power, could not do this, so the heat was intercepted by means of a pipe-stove, which occupied the same position as the boilers spoken of, the air thus heated by passing through the pipes going to the blast-furnace and assisting combustion therein, with, no doubt, a considerable saving of fuel. This procedure is certainly feasible and not to be lightly condemned; yet it is open to the great objection that both furnaces, in order to obtain good results, had to work concurrently, which would be almost too much to expect. Surely one or the other must have halted or been out of step at times. The heating of the blast to copper furnaces, a practice now out of date, has often been accomplished by means of pipe-stoves like that of Bully Hill, but they were heated by an independent fire, which could be urged when the furnaces became torpid, or relaxed when it rose to uncomfortable activity.

This reverberatory, having a hearth area of about 400 sq. ft., smelted, we are told, only about 30 tons per day, or at the rate of 150 lb. per square foot, which is much less than the usual duty. Ordinarily, when cold ores alone are charged the duty varies from 200 to 250 lb., and if heated material, such as calcine, forms the whole or a considerable part, the duty rises to as much as 350 lb., or in exceptional cases to 400 lb. and upward. What the cause of the slow rate of fusion may have been one can only conjecture; but it may have been owing to an overplus of flue-dust, which is notoriously hard to smelt, or to too difficult a charge, by reason of too great a proportion of such an ingredient as alumina, barite, or silica. The smelting mixture indeed seems to have been difficult, not only for the reverberatory but for the blast-furnace as well. At times the silica reached 23%, the alumina 12%, the barite 27%, and the zinc 16%. But not simultaneously, else the furnaces could not have run. The average sulphur seems to have been about 23%, which points to the useful employment of the pyritic process; but the roasting-smelting method was selected instead. Now, the reverberatory process is strongly indicated for such material instead of the blast-furnace; but the reverberatory seems to have been set up for the subsidiary purpose of smelting flue-dust and 'fines'. The mixed plant, although having many modern features of excellence, does not appear to have advanced the art of smelting. The blast-furnace required fluxes to a considerable extent, the surface ores having been deficient in basic elements, and limestone was purchased from the quarries of Holt & Gregg, near Kennett. Iron ore, too, seems to have been added, from the Heroult deposits, some miles to the west. The construction of the Sacramento Valley & Eastern railroad connecting the smelter with the Southern Pacific rendered easy the importation of fuel and fluxing materials.

The average slag falling from these exceptional ores analyzed as follows:

	%		%
Silica	36	Barium oxide	8
Ferrous oxide	21	Alumina	12
Lime	9	Zinc	8

Sulphur, magnetic oxide of iron, and minor ingredients are not stated. The matte contained 39% copper, and was sold to the Mammoth works. The converters then remained idle. The analyses do not indicate it, but it is more than likely, considering the character of the ores, that a considerable proportion of the barite went into both the slag and matte in the form of sulphide. Recent analyses usually show this result, and the conclusion that barite is merely fused in part without being converted into silicate is quite commonly held. The effect of barium sulphate on the smelting process is on the whole prejudicial, since it makes the slag heavier, while the portion going into the matte makes it lighter, thus lessening the difference between the specific gravities of the two, upon which their effective separation depends. Therefore we should expect to find a considerable loss of precious metals in the slag; and this is what is found in practice. From a chemical standpoint one would conjecture that the barite would be more thor-

oughly decomposed in the reverberatory than in the blast furnace, since the familiar reaction between sulphates and sulphides would evidently take place more effectually there, but beliefs on this point rest more upon conjecture than upon direct evidence. Whether the pyritic furnace, run with a minimum of fuel, or with none at all, would produce as thorough a decomposition of the mineral, with the formation of barium silicate as the reverberatory with its customary neutral atmosphere, is a question yet to be settled. Either furnace is capable of fusing the barite as such and driving it into slag or matte, while the coke-burning cupola reduces it to the form of sulphide. An excess of fuel therefore acts disadvantageously, so that with ores of the composition of those of Bully Hill and Afterthought there is no question of the propriety of using either the pyritic or the reverberatory method, even when the question of cheapness had not arisen. This brings us to the consideration of what the Bully Hill ores really were and are.

The valuable metals are gold, silver, copper, and zinc, all combined with sulphur, forming especially blende, pyrite, and chalcopyrite, with less quantities of galena, bornite, and chalcocite. These minerals constitute about one-half the weight of the ore now available, the proportion varying here and there. In some parts of the mines zinc-blende predominates, and there are areas in which it forms from one-half to three-fourths of the whole mass. In other portions pyrite predominates, and in at least one section of the Rising Star mine it forms almost the whole of the orebody. The copper is distributed unevenly throughout, being found in small quantities in all of the orebodies, and varying from 1 or 2% to 6% or more. By careful sorting the company was enabled to ship during 1918 over 25,000 tons of ore averaging 6%, to do which they were obliged to reject a much larger quantity, averaging perhaps 2%. Gold and silver likewise occur in all the ores, as will be seen on inspection of the accompanying assay-returns.

The ratio of zinc to copper in the Bully Hill mine is 2:1;
" " " Rising Star " 10:1;
" " " Copper City " 8:1.

These properties, which began long ago as gold mines, were worked later as silver mines, then by Capt. De Lamar as copper mines, must now be regarded as zinc mines. There is no doubt, however, that copper, in some parts of the lodes, will continue to be important.

Although the zinc is increasing as depth is gained, such is the uneven distribution of the metals that a considerable variety of ores exists, ranging from nearly pure pyrite with but one or two percentages of copper and very little zinc, to heavy blende ores with 30 to 40% zinc and correspondingly little copper and iron. Undoubtedly the properties will be able to furnish considerable amounts of copper ore of a grade suitable for direct smelting, as work continues, but greater amounts of zinc ore that cannot be smelted without the preliminary removal of the zinc. The sulphur content, being contingent upon the associated metals, is necessarily variable. With each unit of zinc there is combined one-half unit of sulphur; with each unit of copper nearly one of sulphur; with each unit of the iron in pyrite there is combined little more than one unit of sulphur. The bodies of purer pyrite must have, accordingly, nearly 50% of sulphur, which constitutes an excellent material for acid-making, and can be profitably sold as such, without regard to its small values in copper and the precious metals.

The stony part of the ore—the gangue—consists for the most part of silica, alumina, and barite. In the proportion in which they occur they form no serious obstacle in smelting, being rejected with sufficient ease. These gangue-minerals would be inert toward dilute acids were it desired to form salts of zinc and copper in the roasted ore; but small quantities of lime and magnesia, amounting to about 30%, might perhaps go into solution. On the whole, a chemical process whereby it were proposed to remove the zinc (and perhaps the copper also) by solution, preparatory to smelting the residues for their gold and silver, would seem applicable. I will revert to this topic, to show its bearing upon a general scheme of treatment of the complex sulphide ores. Anhydrite, the sulphate of lime, exists in these ores; if in considerable quantity, it might be looked upon as a useful flux for the smelter, in view of its favorable reaction upon sulphides in the reverberatory furnace.

The Bully Hill property, after having been in the possession of the General Electric Co. for 12 years, was sold in 1917, through the agency of C. L. Wilson, to an association of Californian financiers headed by Walter Arnstein, for the reported sum of $750,000. The railway and all other improvements were included. The sum seems small for a property of such magnitude, and indeed scarcely covers the cost of the railway. The purchasers have expended money freely in the development of the mines, the Rising Star in particular, and have introduced the flotation process for the concentration of the ores.

The Arnstein association, known now as the Bully Hill Mining Co., extracted in 1918 over 27,000 tons of selected ore, averaging a little over 6% copper, with a dollar or so in precious metals, 5.4% zinc, and 30% iron, making a desirable smelting material. This was in addition to about 2000 tons of somewhat lower-grade material.

Later advices from the mine indicate that the exploration work is proving very successful. Roger L. Beals, general manager, writes, under date of May 22: "We are only doing straight development work here now. We have opened new ground in the Rising Star that has higher grade zinc ore than any shown in the mine at the time of your visit, and with greater width, averaging 25 ft. wide, and assaying over the full width 30% zinc. A good shoot of silver ore has also been opened above the main tunnel level of the Star. The result is to greatly increase the known ore-bearing area. . . . It is probable that we shall put in a good-sized electrolytic zinc plant this fall. . . ."

Mr. Beal's estimates of the ore exposed previously to these new discoveries, show as follows:

In the Bully Hill mine, 50,000 tons of probable ore; Rising Star, just west of the Bully Hill, 147,600 tons delimited ore and 44,000 tons of probable ore; in the Copper City mine, 4000 ft. south-west of the latter, 25,000 tons of probable ore. The average assays are as follows:

	Gold, oz	Silver, oz	Copper, %	Zinc, %
Bully Hill	0.12	6.46	2.33	7.83
Rising Star	0.03	4.00	2.30	23.00
Copper City	0.04	6.085	2.08	17.50

An analysis of a certain portion of the Bully Hill mine product will shed light upon its metallurgical character; it follows:

	%	Insoluble	%
Cu	3.33	SiO_2	23.54
Zn	7.82	Al_2O_3	6.40
Fe	12.68	$BaSO_4$	17.55
Al_2O_3 (soluble)	4.95		Oz. per ton
S	17.15	Au	0.12
MgO	1.47	Ag	6.46
CaO	1.45		

While the Bully Hill mines constitute the most important part of the mining district, there are other claims of great promise, notably the Arps group at Copper City. This group, which includes 14 or 15 locations, was sold lately by the owners, Messrs. Saeltzer, Arps, and associates, to F. B. Hink, who is now engaged in development work. Considerable amounts of heavy sulphide ore, said to carry 5% of copper with 5 to 20% zinc, and about $5 in gold and silver, are exposed, while a large tonnage suitable for concentration is being explored. The ore is said to occur in widths of 100 ft. or more. Some shipments of ore of the better quality have been made to the smelters and more is to follow.

It is a matter of congratulation among the mining operators west of the Sacramento that they have not so much zinc to contend with as their friends east of the river. They do not claim to have none at all, but merely that it is not so abundant as to render smelting impracticable. They acknowledge that in some of their mines the zinc runs too high to admit of smelting, but they look forward to shipping or otherwise disposing of this when the good time of high prices comes again. Meanwhile a good deal of zinc finds its way even into the Mammoth furnaces, the charge of which carries some 4%, whence we compute that some 40 tons or more of zinc finds its final resting-place in the vast slag-dump every day. The market-value of this quantity is hardly more than $4000 now, and therefore it is not worth bothering about. The behavior and destiny of this metal form one of the most interesting of the many interesting topics connected with this plant. The blast-furnaces here, while of quite moderate size, namely, 50 by 180 inches at the tuyeres, are driven rapidly with a blast of 30 ounces, with a shallow charge and fairly hot tops, which conditions would seem to favor the expulsion not only of zinc, but of every other volatile substance. The daily duty is 6.4 tons of charge per square foot of hearth-area, which infers great interior activity. But it appears that zinc is not volatilized largely, as might be expected; on the contrary, it enters the slag and stays with it, except the small proportion caught in the bag-house. The material here caught contains:

	%
Zinc	25
Lead	6
Arsenic	8
Copper	1
Gold	0.03 oz. per ton
Silver	0.5 " " "

Of the zinc, 14% exists as uncombined oxide, and 11% as the sulphate. And here lies an interesting problem. Free sulphur tri-oxide is found in the smoke, and is neutralized with caustic lime before entering the bags, to prevent their corrosion. Why does not the tri-oxide combine with the free zinc oxide while on the way through the long iron cooling system? Some of it does, but why not all? Since 15 tons of fume is collected in the bags each day, three furnaces running, and smelting, roughly, 1200 tons of charge containing, roughly, 40 tons of zinc. The fume contains 25% zinc; therefore only 3.75 tons of zinc escape slagging, which is hardly one-tenth of the whole quantity. Some zinc, in one form or another, may lodge in the dust-chambers, through which the smoke passes on its way to the bags, but as the dust is put through again, it cannot escape that way. It is not a little curious that the pyritic process, which eliminates all other volatile matters so completely, should expel so little zinc. Of course, it may be said that a portion goes into the matte, which is doubtless true; but from the matte it must go either into the converter slag, or into the gases, which go to the bag-house along with the furnace smoke, or else it must go through the slag back into the furnace smoke, which is the destination of all converter slags.

A bag-house is a wonderful contrivance, but as a money-making institution it is not pre-eminent. It sifts out the solid, the coloring matter, unerringly from a hundred thousand cubic feet of smoke every minute and lets the gases go away all but invisible, and everybody speaks well of it. But the fume it collects nobody praises and nobody wants. To re-smelt it would be to return the lead and the arsenic and perhaps other objectionable matters to the smelting system, and thereby increase the collections to an unmanageable extent. The lead, it is discovered, has a tendency to deposit itself in the long steel pipes which form so imposing a part of the plant, and which being comparatively inaccessible for cleaning, produce an obstruction that would be serious. Nor can the collections be economically smelted separately; for the zinc content forbids it. They might, of course, be diluted with non-zinky ore and then passed through a stack, either with or without the bag-house connection, but attention has mainly been given to chemical and electrical methods for their treatment. Many inventors, inspired with such ideas, and assuming that they could furnish a cheap and therefore suitable material for zinc extraction, have put forward proposals that, although never carried out, still gave occasion for the loss of much time and in one or two instances some money. The recovery of zinc by chemical means depends too much upon the

purity of the solutions used to attest to the presence of large quantities of arsenic above all.

The cooling system has been mentioned. This is extensive, consisting mainly of metal pipes through which the smoke passes and in which it is cooled to the temperature—about the boiling point of water—at which the woolen bags are not attacked by the sulphur gases. These gases are two, the tri-oxide and the di-oxide, the latter existing in by far the larger proportion. The tri-oxide is peculiarly virulent, and has a decided effect upon organic matter, especially in the presence of moisture. The bags are defended by withdrawing the tri-oxide from the fume, just before its entrance, by means of caustic lime, which is fed into the stream of smoke. The sulphate of lime is formed, and the smoke, now freed from its more corrosive concomitant, filters through the fabric, separating the solid matter, the character of which has been discussed.

Far from desiring to criticize, but seeking information, I would ask, why are hot gases allowed to reach the cooling system? There are expedients by which this may be prevented without having to employ such an array of costly and cumbersome piping to reduce the temperature. The first and most obvious means would be to feed the furnace deeper and prevent fire-tops, when the smoke would go off at a much lower temperature. This practice should, likewise, lessen the fuel requirements of the furnace. Another expedient presents itself. In the early days of pyritic smelting a number of inventions were put forth essaying to heat the blast by means of the waste heat of the exit gases—the smoke. None of these inventions was particularly successful, because the temperature of the smoke is neither very exalted nor very regular. It may rise at times to 600° or 700°, when the top flames, but is hardly more than 300° or so when the furnace is run, as is done commonly, with what is called the cold top, meaning the condition when fire cannot be seen on the surface of the charge. When the top is hottest and the gases are at such a heat as to make the contrivance effective the feeding of the next charge reduces the temperature and diminishes the efficiency of the apparatus. It follows, then, that as a hot-blast stove the apparatus introduced to heat the blast by introducing coils of iron pipe in the stream of gases was of little use; but if it were desirable, as at the Mammoth plant, to cool the outgoing smoke to a degree that would obviate the necessity of employing outside air to do the work, then the despised hot-blast apparatus might be worth while. A small increment of heat admitting of the reduction of the charge of fuel below 8% of poor coke, and the increased effectiveness of dust-chamber systems, by being compelled to handle a volume of gas much diminished by diminishing temperature, and lessened probability of damage to bags, might, it is diffidently urged, compensate for the trouble of making a change in practice; or, rather, in the construction of future works.

The Sprague process, as the combined neutralization-filtration method is called, was not installed at the Mammoth works without the most careful deliberation; and it is not likely that any considerations of so obvious a nature were overlooked. The skill and care devoted to the conduct of the plant, and indeed of the whole works, are exemplary. It would be difficult to point to a reduction plant in any part of the country which is handled with more address and competence. The air of professional expertness evinced by the officials in charge is truly admirable, and is doubtless due to Mr. Metcalf's life-long experience and Mr. Kervin's 14 years incumbency at this one plant. If anything were needed to prove their efficiency it would suffice to point to the fact that the great establishment has succeeded financially while smelting a mixture that year in and year out contains only 2½% copper, with hardly more than two dollars per ton in gold and silver, and pays a profit. The uninitiated should learn that all this material, amounting to 1000 tons per day, has to be sampled, assayed, weighed, placed in bins, drawn out and trammed to the furnaces, melted with suitable fluxes, the slag is drawn half a mile to the dump and discarded, the matte is bessemerized in acid-lined converters, the copper bars are shipped to New Jersey and refined, the gold and silver are separated, and the products sold; to cap the climax, the fume has to be collected in the bags and disposed of, and then the smoke, deprived of its solid components, has to be discharged into the atmosphere in a manner to suit the tastes and desires of neighbors. How all this can be done with ore of this description passes understanding. The ore treated is not derived wholly from the company's mines, though these are large and highly productive. A great deal is purchased from mines in distant regions, and well paid for. Not only does the Mammoth concern pay its own profits, but it enables several others to make money. Thus, the Balaklala, which contributed nearly 80,000 tons of sulphides to the Mammoth plant last year, was able to pay to its stockholders a dividend of $175,000, although its ore contained a little more than 3% copper, with 1¼ oz. silver and 75c. in gold. This ore had to be mined, transported by aerial tram to the railway, and freighted to Kennett, a rail haul of five miles. That a dividend was paid out of such ore is due in part to the war price of metals, but largely to excellent management of the Balaklala company.

It is desirable to bear in mind the gradual impoverishment of the Shasta ores, during the 20-odd years of smelting activity; how, beginning with an average of 7% and even higher, at Iron Mountain, and nearly the same at Bully Hill and Afterthought, the tenor has now fallen to 2 or 3% in run-of-mine, and with little prospect of finding extensive orebodies of much better class.

Returning to the matter of bag-house sublimates—it would appear from the experience at Mammoth that the current notions as to the volatility of the metals are fairly borne out, excepting as to the zinc. Under circumstances analogous to those at plants where the expulsion of the whole or at least the greater part of that metal is achieved, the ratio of the expelled zinc to that portion retained by the slag is, as we have seen, but 1 : 10 or thereabout. In regular practice at Canyon City, Colo-

Lake and similarly elsewhere, zinc ores were subjected to a blast comparable in intensity to that employed at Kennett and using a much greater proportion of carbonaceous fuel, and the result was to expel by far the greater portion of the zinc, the process being the Bartlett method, which would seem to differ in no essential from that employed at Kennett, with the exception that the depth of charge was much less. The disparity of results is certainly inexplicable.

In other respects the sublimate appears to accord with ordinary experience. The silver, which under these circumstances is noticeably volatile, is concentrated in the bag-house fume to a considerable extent, the assays showing an enrichment of about three times the content of the ore; so that by comparing roughly the collections with the amount in the charge it is found that about 5% is volatilized; or more accurately stated, about 5% of the total silver is retained by the bags. It is apparent that this must have been in the gaseous form when it left the furnace, and in the solid form when stopped by the bags. It is possible that a further quantity may have escaped condensation and have passed through the interstices of the fabric. This, indeed, is probable; for it is hardly to be imagined that the act of condensation to the solid form took place in consequence of contact with the bags themselves, but rather was brought about by the cooling. Of one thing we are assured: the 75 oz. of silver caught daily in these bags would infallibly have been lost into the air without them, nor would the loss have attracted notice. It is therefore pertinent to inquire if the same or a greater loss is not incurred at every matting or lead-smelting works from true volatilization, unchecked by condensing apparatus. The matter appears to resolve itself largely into the question of dust-chamber effectiveness, in which the cooling effect of extended surfaces is interwoven.

The comparative volatility of gold has been mentioned in connection with the subject of chlorination. Under the assumption made as to the amount of precious metals contained in the smelting charge at Mammoth, taken in connection with the quoted assay of the bag-house fume, it is seen that 1.5% of the gold is caught in the bags, which is about one-third as much as in the case of silver. This corresponds well with what is known of the relative volatility of the two metals, but, as in the case of silver, it does not afford quantitative evidence of the actual volatility. The query persists as to the amount that may possibly escape through the meshes. It is evident that an important field of experiment and conjecture remains open in this respect. The quantity of metallic vapor still remaining in the fume after cooling to the boiling-point of water or lower is doubtless very small; it may be that none at all remains; but it is probable that actual investigation of this difficult matter has not yet been made.

In Ecuador the production of gold bullion in May was 239.8 troy lb., cyanide precipitates, 1710 lb., and cyanide metallic precipitates, 900 lb., all of which was exported, as is the case each month. Considerable quantities of gold are produced by hand methods in various parts of the country, the exact amount not being known. About 3500 bbl. of crude petroleum was produced during the month, all of which was consumed at Guayaquil. A British house has purchased a large tract of oil-bearing land near Santa Elena, and has received equipment from the United States. It is intended to drill for a number of wells. The manganese mine north of Quito is not operated now, as no market could be found for the product.

Australian Brown Coal

A threatened but averted strike of the coal miners of New South Wales and an actual coastal shipping and wharf labor strike, which has caused a shortage of coal in several States, particularly Victoria, has revived interest in the remarkable deposits of so-called 'brown coal' in the Gippsland district, Victoria. This seems to be coal in the process of formation, not completely carbonized, but enough to make it a good fuel for many purposes, though not for the manufacture of coke. If mixed with wood or black coal it can be used for domestic purposes. It looks like something between wood and coal. Chunks of wood have actually been found imbedded in the brown coal, and lumps of the coal itself frequently exhibit the grain of wood. The deposits are supposed to be the residuum of vast pine forests which covered part of the State of Victoria in prehistoric times. The coal in its present form is softer than bituminous, and is dull black or snuff brown in color. These brown coal beds are said to be the thickest in the world. At Morwell 780 ft. of coal has been passed through in a bore of 1010 ft. The four principal areas of occurrence cover approximately 1200 square miles of an average thickness of 50 ft. The depth of the coal seams below the surface varies from 60 to 500 ft., the average being nearer the first figure. The total amount of brown coal in the four distinct large areas and numerous small and widely divided deposits is estimated at 30,000,000 tons. No extensive mining operations in these areas, which are controlled by the State of Victoria, have yet been carried on. Up to 1916, the last year for which official figures are available, the total amount mined was but 84,663 tons, and the 1916 production was only 2915 tons. But plans are now being made for a more rapid development, which will doubtless be accelerated by the present abnormal demand created by the strike situation. Before the War a private syndicate, said to have a backing of $100,000,000, was negotiating for one of the larger deposits, but the State did not think it proper to permit a private company to acquire so valuable a natural asset. A typical analysis of the brown coal at Morwell, the centre of the largest area, showed the following composition (in percentages): Water, 53; volatile matter, 24.50; fixed carbon, 21.50; ash, 1. Further tests showed sulphur, 0.7%; nitrogen, 0.3%; calorific value, 5500 to 6000 B.t.u.; evaporation value, 4 lb. of water; gas per ton, 6500 cu. ft.; ammonium sulphate, 32 lb. per ton.

Mine Sampling

By LEON FEUCHERE

*In the mining of copper ore in the Warren district, where orebodies are small and irregular, and where the grade of the ore throughout an orebody is also liable to be irregular, there are two more or less antagonistic factors to be considered. The first is the cost of mining, and the second is the grade of ore mined. In order to get a low cost, it is always a temptation to mine as big an area as possible all together, thus getting a larger tonnage per man-shift. In doing this, however, the grade of the ore is liable to suffer. There is a happy medium between the high cost required to obtain absolutely clean ore and the cheap cost to obtain a poorer grade of ore. It is this happy medium for which one should strive.

The final result, that is, the cost per pound of copper, is the one to be considered. For example, if in any stope it costs $1.60 per ton to land absolutely clean ore in the stope-chutes and if the ore runs 8% copper or 160 lb. per ton, the cost per pound will be 1.60 ÷ 160 or 1c. per pound. If, on the other hand, by no sorting the cost can be reduced to $1 per ton, the grade being reduced to 4% or 80 lb. per ton, the cost per pound will be 1.00 ÷ 80 or 1¼c. per pound. Again, if the grade can be increased to 7% or 140 lb. per ton by judicious sorting, thereby increasing the mining cost to $1.30 per ton, the cost per pound will be 1.30 ÷ 140 or 0.9c. per pound, which will be the best thing to be done. This, however, brings in another factor. If the waste in the stope runs just below the minimum, and, therefore, will produce some copper, the above method of figuring will be correct. If, however, as in a good many of our oxidized orebodies, the waste consists of absolutely barren limestone, it will always pay to spend enough money to sort it out or an amount equivalent to what it would cost to handle the waste from the stope to the smelter. Re-figuring our example again, for absolutely clean sorting, the cost is $1.60 per ton, for 8% or 160-lb. ore, and the cost per pound is 1c. per pound of copper. If by fair sorting the grade is reduced to 7% or 140 lb. per ton, at a cost of $1.30, the apparent cost is as before, 1.30 ÷ 140 or 0.9c. per pound. But for every ton of 7% ore, one-eighth of a ton of absolute waste is being mined. To get a ton of material from the stope to the smelter it costs about $1.55, figuring tramming, hoisting, and freight. This does not include the charges of development, dead work, drainage, sanitation, accidents, taxes, assaying, sampling, and miscellaneous expenses. In addition to this, the smelting charge is approximately $3. The total charge against this eighth of a ton of waste will, therefore, be 4.55 ÷ 8 or 57c., which must be added to the stope cost. Therefore, for fair sorting the total cost per pound will be $1.30 plus 57c. divided by 140, or 1.3c. per pound. For still poorer sorting, the cost will be higher yet, as can be readily seen.

The Copper Queen figures out each month a grade of ore for each stope, which will just pay expenses. This grade is called the 'minimum' for the stope. It depends upon and is figured out from three factors, the market price of copper, the stope cost, and the smelter cost, which depends on the kind and amount of impurity in the ore, that is, the amount of fluxing material, such as iron, sulphur, and lime, and the amount of material requiring fluxing, such as silica and alumina.

Correct sampling is one of the most difficult operations connected with mining, as a small sample is supposed to represent the grade of a relatively large amount, and any error in the sample makes an enormous error on the whole. To bring this point out, the samples sent to the assay-office are crushed up and only a very small weight is used for the actual assay, the rest, called the 'reject', being sent back to the ore-chutes. For the last six months of 1918 there was mined a total of 337,673 tons of ore. The assay-office rejects in this period amounted to 901 tons, or only 0.27 of 1%. For this reason it is necessary to check the samples several times in order to get as reliable results as possible.

The route of the ore and where it is sampled are as follows: First it is sampled before breaking in the stopes. This is done by the shift-boss. It is sampled by the trammers as they draw the chutes, each car being sampled by means of a sample shovel, and the sample is put in powder-boxes or special sample-bins. It is again sampled at the bottom of each haulage-chute by the motor crew. No further sampling is done underground. The final Bisbee sample is that taken at the belts at the Sacramento shaft. This is done by a special sample crew, a shovelful being taken for every 12 ft. of belt, a bell ringing to indicate where to sample. Twelve feet of belt represents approximatly one ton of ore. This belt sample gives the most accurate results of all, and checks the smelter almost exactly. It gives the sample for each haulage-level and can be checked against the chute samples. It is found to be nearly always about 0.4% lower than the chute samples.

The reasons for the chute samples being high are, first, the tendency of the trammer to pick out the easiest part of the car, that is, fine material; and second, it is human nature to want to get a good grade of sample from the place in which you are working. In order to take a reliable sample, it is necessary to shut your eyes and stick your shovel into the car, taking out whatever comes on the shovel. As a matter of fact, this cannot be done in

*One of the bulletins of the Practical Mining Course established by the Phelps Dodge Corporation at Bisbee.

practice, so that more fine is taken than represents the average content of the car, and to make the sample look reasonable a boulder or two is added, which is usually of a better grade than the average. The reliability of the chute samples depends on the interest taken by the shift-boss in giving the trammer proper instructions and impressing on him the importance of this phase of his work.

In taking samples in the stope, the method depends on the kind of ore mined. If the ore is uniform and no sorting is possible, the whole face should be sampled by taking a groove from side to side or from top to bottom, depending on the way the ore lies. In this kind of ore, when the face is being drilled, the drillings from all the holes yield the most reliable sample. In taking a pile sample, pieces should be taken from all through the pile, taking a pick and getting some from the bottom and inside of the pile as well as from the top.

If the ore is one that requires sorting, there are no fixed rules. The sample from the face will depend on the judgment of the shift-boss as to what can be and what will probably be sent down the chute. In this case it is always better to take a too low than a too high sample. Drillings are apt to be unreliable in this kind of ore. Pile samples are probably the most reliable of all, as after the ore is broken it is easier to see what can be sorted out.

The relation of the sampling department to the mine department is analogous to the relation of an auditor to a book-keeper. The sampling department checks the samples where errors appear to have been made, throughout, from the stope to the belts. They have more time for this work than the shift-boss, and their samples are more liable to be correct. Being outsiders (like the auditor) they are more liable to detect errors than the man on the job, and like the auditor, they have the whole process before them, and not just one phase of the work.

In addition to the regular mine work, special sampling is done in some cases, such as in the development of new country. This is done when an accurate estimate of the grade is necessary, as in country where the ore will have to be concentrated, or where it is to be treated separately. In this case, the drifts and raises are sampled by grooving. A large piece of canvas is spread over the drift-bottom and a groove is cut about six inches wide and half an inch deep, using a moil and a single-jack. All chips are caught on the canvas, and represent accurately the value for each distance of drift grooved. Usually they are taken five feet long and are cut horizontally. If the ore lies in horizontal layers, the grooves are made vertical, from top to bottom every five feet along the drift. All raises are sampled in the same way. This work takes time and is done by specially trained samplers.

The general route of the samples is as follows: They are first taken by the bosses and trammers to the cage and thence to the surface. From here they are taken to certain convenient points and are gathered up about 9 a.m. and 1 p.m. by a special truck from the machine-shop and taken to the assay-office. Those gathered at 9 o'clock are then taken out in the bucking-room. Here they are dumped out into iron pans, one for each sample, and the tags put into the pans. They are then put into the drying-ovens. After drying, they are crushed in a small crusher and cut down into two parts, one being the reject and the other used for the actual sample. The sample is then bucked on a bucking-table and thoroughly mixed. A small part of this is then weighed out for the actual assay. They are kept throughout in absolute order, and are then assayed by wet methods for copper, and the results posted in ledgers under the heading of the original tag. They are then transferred to the report sheets, which are ready at 11 o'clock. At 11:30 they are gathered up by the messenger and taken to the shafts, arriving there shortly before 12 o'clock. The results of the 1 o'clock samples are sent out the next day together with the morning samples. Every step is thoroughly systematized at the assay-office, so that the chance for mixing samples is slight.

In conclusion, the object of all sampling is to get a representative portion of the ore. The more uniform the ore is, the more reliable a small part of it, represented by the sample, will be. When an ore is spotty, and requires sorting, and in general for any sample, the larger the better, the best of course being the smelter returns on the whole ore. In stope sampling, the larger the samples the better. In chute samples, the human element should be eliminated just as far as possible. The object of what is being done should always be borne in mind and a sampler should always be on guard to keep from fooling himself.

ACCORDING TO FIGURES recently compiled, the production of Chilean nitrate during May, 1919, amounted to 3,039,390 Spanish quintals (1 Spanish quintal is equivalent to 101.44 pounds). This was a decrease of 2,256,839 quintals compared with the same period in 1918. From July 1, 1918, to May 31, 1919, production totaled only 47,821,761 quintals, whereas for the same period in 1917 and 1918 it rose to 59,511,277 quintals. Normally, however, production and demand centre around 40,000,000 quintals yearly. At present the amount exported is negligible, and it is estimated that if the present rate of production is maintained and there is not a corresponding demand established before the end of the year, there will be a sufficient quantity of nitrate on hand to take care of all normal demands for one year from January 1, 1920.

SINCE EGYPT is totally destitute of fuel except that furnished by the scanty trees which grow along the cliffs bordering the Nile, all of the fuel used must be imported. In 1916 over $25,000,000 worth of coal was imported, much of this being needed for the cotton and sugar plantations and other industries. Under present conditions it seems probable that American coal could be delivered in Alexandria as cheaply as that from England, but this is a matter which could only be decided in actual practice.

REVIEW OF MINING

ARIZONA

DOUGLAS, JEROME, HUMBOLDT, DUQUESNE, COURTLAND, SILVER BELL, BENSON

DOUGLAS.—More than 13,000,000 lb. of copper was made at the Calumet & Arizona and Copper Queen smelters during July, and both smelters are expected to show a considerable increase for August. The Copper Queen production for July was 8,400,000 lb., an increase of 1,200,000 lb. over June. It is expected that the August production will be about 9,000,000 lb., or a little more than half the war time capacity of the plant. Four blast-furnaces and one reverberatory were in use in July. The C. & A. made 4,854,040 lb. of copper. Three reverberatory furnaces were in use during the month, but both blast-furnaces of the plant remained cold. The production of sulphuric acid at the smelter reached normal before the end of July and continues to be made at the rate of 200 tons per day. The output of both smelters includes both company and customs ores.

JEROME.—United Verde Extension plans to hold to a production of 3,500,000 lb. per month for the present, according to an announcement made at the offices of J. S. Douglas. The approaching completion of the ore-haulage tunnel from the main shaft has released a number of men who have been engaged upon this work and they are being placed underground as rapidly as possible.

HUMBOLDT.—The Consolidated Arizona Smelting Co. produced during July 650,000 lb. of fine copper in bullion, it has been reported. The ore treated came from the Blue Bell and De Soto mines of the company, 11,400 tons being shipped to the smelter. The company's production now stands at about half that of last November.

DUQUESNE.—Engineers in the employ of the Phelps Dodge Corporation were reported recently to be examining the properties of the Duquesne Mining & Reduction Co. at Duquesne and Washington camp. This has given rise to a rumor that a deal is pending. Some years ago the Phelps Dodge interests endeavored to buy the Duquesne mines and offered a substantial price for them, which was refused. Following the death of Mr. Westinghouse, however, his heirs decided to give up mining and are understood to have offered the property for sale at $150,000. The equipment alone is said to be worth this amount. At the present time Curry and Pannick have a temporary lease on the Duquesne mines and are shipping about 400 tons of ore per month to Douglas for smelting. Should the Phelps Dodge interests take over the Duquesne property it is considered likely that the El Paso & Southwestern railroad would extend its branch line from Fort Huachuca, thus giving a direct haul from the property to the smelter at Douglas and obviating the handling of any part of the haul by teaming, the method now employed. The right-of-way is said to have been surveyed several years ago, passing through the Cannille mountains and San Rafael valley.

COURTLAND.—The Great Western Copper Co. has received and installed considerable machinery recently with the intention of further developing the property, according to R. M. Kinney, who was a recent visitor. One improvement planned is the enlargement of the working shaft. Several lessees are working on the property of the Great Western and the Leadville and are making frequent shipments of ore to Douglas.

SILVER BELL.—Edward Massey, Deputy State Mine Inspector, who returned recently from a visit to Tucson and the Silver Bell district, reports gratifying resumption of development work and mining in both districts. Silver Bell has reopened after having been closed since shortly after the signing of the Armistice. Its war-time production was quite profitable. Of the properties there, Mr. Massey reports that El Tiro, which is being worked by Percy Williams, is employing a force of 35 men and shipping 450 tons of ore per month. The North Star mine in the Twin Buttes district, belonging to the Midland Copper Co., has struck a 4½-ft. vein of ore in the main drift on the 250-ft. level, carrying 5% copper. The Queen, also owned by the Midland company, has shipped 200 tons of 15% ore since being reopened. At Mineral Hill, the Consolidated Copper Co. is doing development work and has opened a large body of ore on the 700-ft. level, which is being shipped to Tucson. The company plans to construct its own mill within a year.

BENSON.—Work on the plant of the Arizona Smelting & Power Co. is progressing so rapidly that it is now expected that the smelter will be ready to be blown-in about September 1. Grading for the installation of a new spur track from the main line of the Southern Pacific railroad is about finished. The concreting of the fume stack and dust chamber also has been finished. A compressor has been installed and is ready to start, and the boilers are ready for the lighting of the fires. The large fuel-oil tank for the plant has been completed, but it is necessary to extend the spur track which will serve it. A large cement cooling-tank for water has been completed and filled. The offices have been completed and now are being painted. The present furnace

capacity of the plant is 200 tons per day, but it has been built with the idea of probable expansion later. Ore already has begun to arrive and is being stacked ready for treatment when the plant is blown in. Much ore has been contracted for with the idea of building up a considerable reserve. The generators for the power-plant have been shipped from Denver and are expected to reach Benson in a few days. The company has contracted to furnish light and power to the town. R. L. Lee, who has had charge of construction at the smelter, will be its superintendent in operation. Martin Fishback is general manager. Mr. Goetz, secretary and treasurer, believes that after a few months of operation it will be found necessary to increase the size of the smelter, and states that plans have been made for such increase up to 1000 tons per day capacity. The smelter will afford a market for the ores of the Johnson district and numerous small mines on the San Pedro river, below Benson.

The return of confidence in the copper situation has been indicated recently throughout the smaller properties of southern Arizona by reports of junk dealers in Tucson and Douglas. About two months ago when copper hit the zero point, the owners of a number of prosperous little properties dismantled their plants of machinery and sold it to junk dealers. Within the last two weeks these same miners have been hunting up their machinery at the junk shops and securing its return by paying the junkmen a handsome advance over the selling price of sixty days ago.

Superior.—It is estimated that the tunnel leading from the surface plant to the 500-ft. level of the three working shafts at the Magma mine will be completed and ready for use about next January.

CALIFORNIA

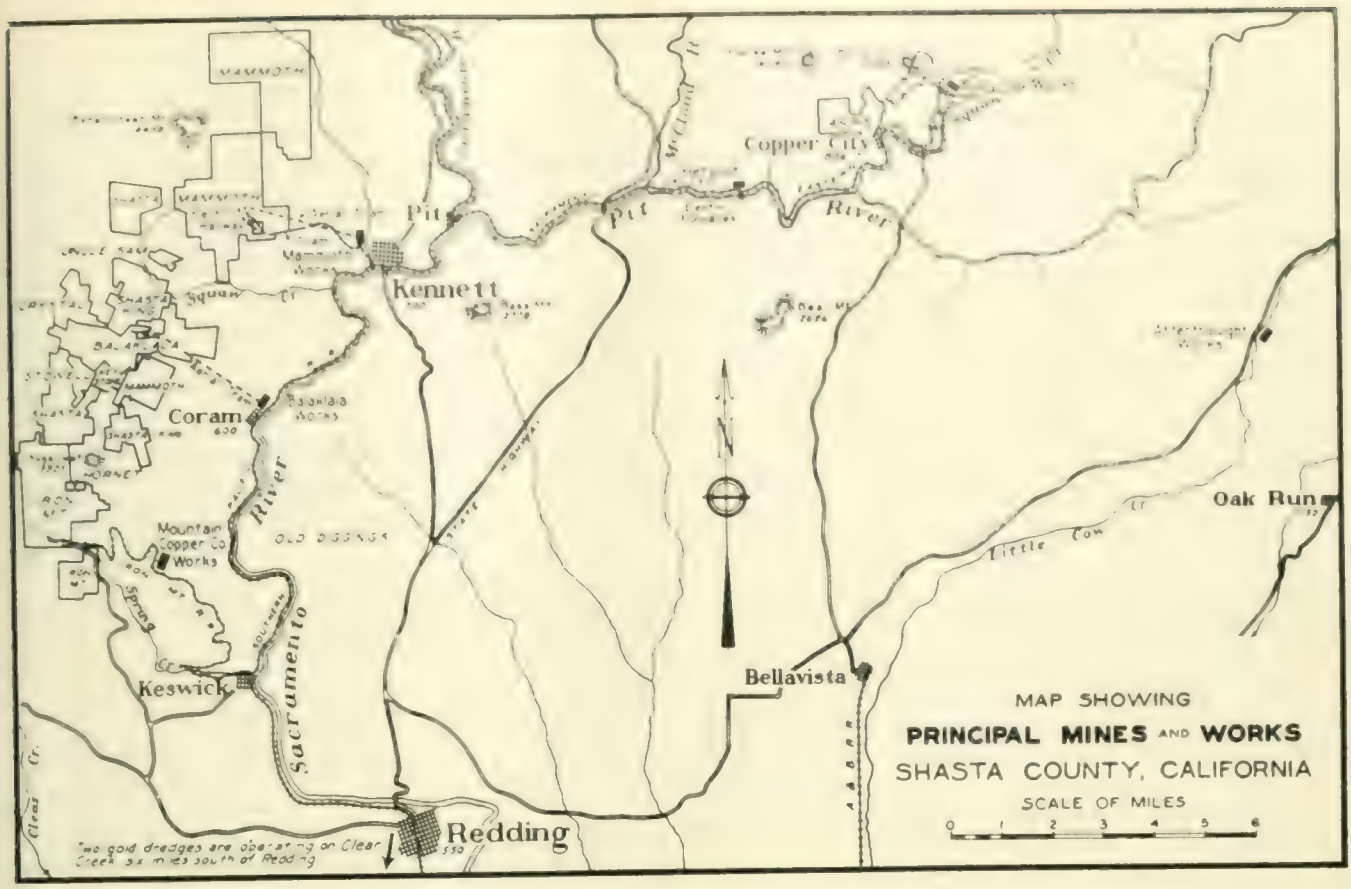
NEVADA, PLACER, AND SIERRA COUNTIES.

Nevada County.—A special meeting of the Mine Workers Protective League of Grass Valley was called for the 16th instant "to decide what action shall be taken regarding non-union mine-workers of this district"; also to propose amendments to the constitution. There are over 750 registered members of the League and it would appear that it does not intend that non-members shall be allowed to work in any mine the superintendents of which were not a party to the amended agreement adopted in July and under which the men returned to work. The store feature part of that agreement which was brought about by the charge of unusual high prices prevailing in Grass Valley and was one of the principal causes which led to the strike, is still in abeyance; no move has yet been made by the companies to furnish ordinary living foods and supplies at cost. One large firm in town is operating on a two-price system—'cash' and 'carry'—but is in no way connected with the mines.

Peter Bender, of San Jose, on August 12 bid in the Mountaineer Mines Consolidated for the sum of $151,474.65 on a judgment and accruing costs. The plaintiff loaned large sums to the company, taking its note secured by a mortgage. The mines are close to Nevada City and cover a large acreage. The Golden Center Mining Co. recently cut a 2-ft. vein of high-grade ore in the west drift on the 500-ft. level. The find is encouraging and active development will commence at once. At a meeting of the directors in Sacramento Rodney McCormack was elected president; J. W. Howard secretary; Albert Bellania, director; and George H. Alltucker, a director to succeed C. A. Brockington, who resigned as such, but retains his position as superintendent. Preparations are being made to reopen the old Kenosha quartz mine in the Rough and Ready district and work will soon commence. The Kenosha company has been transferred to the Alcalde Gold Mines Co. George W. Root and Eastern associates took over the property. The first work will be to pump out the shaft, about 400 ft. deep, and for that purpose one of the Brunswick pumps will be used. The Kenosha has produced considerable jewelry store ore, although worked in a haphazard manner. At the same time there has been a heavy production of milling ore. The new operations will be in charge of Lloyd Root, son of the promoter.

The Sierra Asbestos Co., operating near Washington, has commenced for the season with a small crew. A suit involving title to the ground was tried in the Superior Court last June and the judge has not yet handed down his decision.

The proposed dam near Bullard's Bar, 20 miles west of Grass Valley, the first unit of which is now under construction, has started the Anti-Debris Commission into active opposition. The dam is for the purpose of creating a vast settling basin for hydraulic tailings and also for a reservoir to be drawn upon for the generation of electric power. The tailings would come from a renewal of hydraulic mining in a number of the old camps in Sierra and Nevada counties, the dam to ultimately hold ten million cubic yards. The fact that the dam is well in the foothills and to be of massive concrete construction avails nothing. District Attorney Coats of Sutter county has made a report to the supervisors of that county concerning the work done by the Commission the past year in holding hydraulic mining in check. In this report Coats admits that a dam for this purpose should be of the most substantial character, but at the same time stated that Sutter county should oppose its construction if at any time it appeared that the body of tailing was likely to find its way into the lower water courses. He based his statement upon a dam now being built at Liberty Hill in Nevada county and entirely unsuited to the demands which will be made upon it. He also advised the Commsision to close down all mines operating behind dams of flimsy construction and cited the Omega dam, which broke down last winter under the pressure of heavy storms. Coats also reported that hydraulicking was being done on streams that were tributary to the American and upper Sacramento rivers and cited one instance where a party operated over a month



without a permit. At this writing no legal proceedings have been commenced against the Marysville-Nevada Water & Power Co. to compel it to cease operations on its dam at Bullard's Bar; nor is it at all likely that such will be done until the first unit is finished and ready for the test. The Anti-Debris Commission may then fight the case.

PLACER COUNTY.—James Garvin has sold a 40-acre gravel tract near the Mayflower mine at Forest Hill to Elwood Dorman of San Francisco, H. L. McCullough of Denver and others. Machinery and supplies are already on the ground.

SIERRA COUNTY.—E. M. Doak, of San Francisco, recently paid a visit to the Young America mine, a producer of many years ago. A rumor is current that a small force will be put to work next month. John Mansfield is negotiating with Los Angeles men for a bond on the Shamrock quartz claims. The management of the Kate Hardy quartz mine near Forest City is making headway in every direction so that operations may continue during the coming winter. W. M. Cooper of San Jose is president of the new company, but the East is furnishing the money. The annual meeting of the Gibraltar Consolidated Gold Mining Co. was held in Downieville on the 4th instant, at which time Jacob Kieffer, Adam Kieffer, Peter Kieffer, W. I. Redding, and H. S. Tibbey were elected directors for the coming year at the mine. A raise is being cut for air and the tunnel is being driven ahead. R. G. Gillespie, of Pittsburgh, is looking after his interests in the Monarch and Cleveland quartz claims near Sierra City.

NEVADA

GOLDFIELD, AUSTIN, ROCHESTER, AND DIVIDE.

GOLDFIELD.—The Goldfield Development Co. is extending the main drift from the 380-ft. level of the Combination into the Florence Goldfield in order to intersect the Riley lease workings. It is expected that they will be cut within 300 ft. This area has produced much high-grade ore, and has extensive new territory inviting development. The company has given a lease on the Combination No. 2 claim to the Florence Goldfield Co., which has started exploratory work from the 350-ft. level. Ore sampling $52 per ton is being opened in the Red Top mine above the 120-ft. level, and A. I. D'Arcy, the manager, estimates 400,000 tons of profitable ore indicated in this area, instead of the 200,000 originally computed. The Red Top and Combination deposits above the 200-ft. levels are to be worked by the glory-hole method, and the 1,500,000 tons on the 380-ft. workings of the Combination by the caving system. Red Top ore will be mined through the first level of the Laguna shaft, and the Combination output by way of the January shaft on Combination Fraction ground. The January shaft has been provided with the powerful electric hoist formerly in operation on the Mohawk shaft. Mr. D'Arcy estimates the 1,500,000 tons of ore in reserve on and above the 380-ft. level of the Combination averages $5.60 per ton, which should yield the company a net profit of $3,000,000. The 1200-ton Consolidated mill is being provided with new belts and is scheduled to go into commission early in September.

R. C. McCarthy, superintendent of the Florence Gold-

field, reports that the extension of the Jumbo vein beyond the east-west fault in the Florence has apparently been found on surface. At point of discovery the vein is 60 ft. wide, strikes to the south, and was found on the Cornishman claim. Cross-cutting has started from the seventh level to explore the vein. Shipments of high-grade ore continue to be made from the 400-ft. level by the Florence Divide lease and from the seventh level by the Giles lease. The Crackerjack company has arranged for extension of a cross-cut to the Crackerjack veins as soon as the winze reaches a depth of 440 ft. On the 380-ft. level the vein is 18 ft. wide with 8 ft. sampling $25 per ton in gold and silver. Ore is to be sent to the Consolidated mill as soon as the capacity is increased to 2000 tons per day. Construction of an aerial tramway from the Crackerjack shaft to the mill is under consideration by H. G. McMahon, the manager.

Austin.—Ore containing native silver and free gold has been struck in the main tunnel of the Austin Nevada Consolidated, according to an announcement by H. G. Richardson. Two high-grade veins have been cut and work is proceeding to determine extent of the deposits. The tunnel is advancing on an orebody 73 ft. wide sampling $8 per ton. The material is badly leached. To the east of the main tunnel an orebody in porphyry is showing a width of 70 ft. Plans for a mill are under consideration.

Rochester.—Shipments of selected ore from the Abe Lincoln mine, on Gold hill, have been started by Rochester Lincoln Hill Mining Co. The vein ranges from four to eight feet wide and has been opened to a depth of 100 ft. by a tunnel. Shipments average around $100 per ton, silver predominating. John L. Munzer, of Pittsburgh, Pennsylvania, is president, and W. H. Scott, of Rochester, secretary.

Divide.—Figures prepared by W. A. Ingalls, sheriff of Esmeralda county, while assessing in the Divide district, indicate that not less than 600 men are employed there. Sheriff Ingalls estimates that there are 80 plants of machinery being used in mining in the district.

E. A. Byler, engineer for the Florence Goldfield, estimates the production of the mine for the past 30 days at $109,430, all ore being mined by lessees. Control assays made by the Florence company on the recent large shipment from the Florence Divide lease indicate the total value of the shipment will be $93,033. It is improbable that the gross value of the shipment will be more than this sum, according to Mr. Byler. The gross value of 36 tons shipped by the Giles lease was $10,097, according to smelter returns. The net value was $8986, of which $6403 was the share of the lessees. Since the rich shipment the Florence Divide has sent to the smelter 170 tons of ore of an estimated total value of $5100. The Arnold lease shipped a carload valued at $1200. The Goldfield Development Co. on August 15 shipped the first ore to the mill. These shipments, which are being made from the Red Top, will be continued until the 5000-ton mill-bins have been filled. The company now employs 125 men in the mines and mill.

WASHINGTON

GENERAL NEWS OF FERRY COUNTY.

Ferry County.—E. N. Patty, mining engineer for the Washington State Geological Survey, is at Republic, examining the mines of the district to obtain information for a report on the metal mines of the State. He has been working here quietly for 10 or 12 days and has already been through Stevens, Okanogan, and Pend Oreille counties and lately visited Park City, Nespelem, and Sheridan camps, which are partly in Ferry and partly in Okanogan counties. Keller is reported to be on the eve of a boom, and evidently there is capital going into that camp. A Mr. Blevin, of Spokane, representing the Northwest Mines & Metal Co., is reported to have bought several claims on Meadow creek belonging to J. E. Jannot and a Mr. Colby, and will soon begin work on them. Work is progressing rapidly in the adit of the Addison mine, with still a long distance to run. The Illinois Mining Co. is expecting to send a representative into camp to direct operations.

WISCONSIN

HIGHLAND, LINDEN, LIVINGSTON, CUBA CITY, BENTON.

Highland.—The New Jersey Zinc Co. has developed and equipped four new carbonate zinc-ore producers in this camp, called the Eberle, Esch, Topp, and Minter mines. Shipments of ore run from 4 to 10 cars weekly, the ore going to the company's smelters at Depue, Illinois.

Linden.—Ross Bros. Mining Co. has picked up an extension of the Ross range, one-half mile north-east of workings mined profitably for 12 years. The surface rig will be removed to the new mine-site and a two-compartment pump and hoist shaft will be sunk without delay.

Livingston.—The Vinegar Hill Zinc Co. (Marks Mfg. Co., Chicago, owners) has resumed operations with a force of 100 men on the Yewdall and Dale mines after a shut-down of six months. A new concentrator is in operation for the first time. The plant and mines represent an investment of $200,000.

Cuba City.—The Zinc Hill Mining Co. has developed two new zinc mines in this district, known as the Little Dick and Big Dick. On the former a strong vein of sphalerite is followed on a mining level only 130 ft. deep. A new mill is recovering concentrate assaying 54% zinc. The shaft on the Big Dick, completed August 1, is in zinc ore at a depth of 108 ft. Charles Wolf, president and general manager, has been authorized by the Zinc Hill directorate to expend the sum of $100,000 for further exploration work in the zinc areas of the Wisconsin field. Leaseholds have been obtained on 5000 acres of land, most of which is contiguous to abandoned properties. A battery of five drill squads is proving this ground. Electro-static ore-separating plants will be installed at convenient points. Connecting Link Mining Co., a newly developed zinc-ore producer, is shipping 4 to 6 cars of low-grade zinc concentrate weekly.

Big Elgin Mining Co. is resuming on the Roosevelt lease. The National Ore Separators and Linden Zinc Co. are handling from 1000 to 1500 tons crude ore weekly.

Rosiclare.—The Wisconsin Zinc Co., operating the C. A. T. mine, Champion, Longhorn, and Winstall mines, is leading the field on production and through its roasters is marketing large quantities of premium grade blende. The New Jersey Zinc Co. has two producers in this camp, the Penna-Benton and Hoskins mines. The latter has yielded as high as 20 cars of crude ore in a single week. Frontier Mining Co. is actively engaged with the Bearcat, Middle, Bull Moose, and Hird mines. The Indian Mound Mining Co. is shipping regularly. The Rodhams mine, an indifferent zinc ore and lead ore producer for several years, has blossomed out recently and is now engaged in shipments of zinc ore to local refiners at the rate of two cars daily. Heavy overflow is giving the Jefferson and Monmouth producers a battle, but men manage to get below at intervals and shipments of two cars of zinc ore per week is maintained. The Graham mine at Millbrig is good for five cars weekly; North Unity mine, three cars weekly; Blewitt mine, four cars weekly; and Black Jack mine at Pilot Knob, five to seven cars weekly. The Galena-Joplin ore-separating plant, after a protracted period of idleness, is again in active operation, affording low-grade producers an avenue of outlet through ore-dressing now available at this plant. The Eagle-Picher company has purchased the Lanyon smelter at Hillsboro, Illinois, and a new buyer for the Eagle-Picher has been established in the Wisconsin field. The United Zinc & Smelting Co. is also newly represented in this field.

BRITISH COLUMBIA

FAILURE OF THE FRENCH PROCESS. GENERAL NEWS OF THE PROVINCE.

The Complex Ore Reduction Co., Ltd., which was organized some time ago to develop the French process for the extraction and electric precipitation of zinc from complex zinc-lead ores, has closed down, and Mr. Thomas French, son of the inventor of the process, is leaving for eastern Canada. The company was backed heavily by the British Columbia government, which guaranteed the bonds to the extent of $65,000. This, of course, the Government will lose. The recent report of the Hedley Gold Mining Co., operating the Nickel Plate, in the Osoyoos district, shows that 67,313 tons of ore was mined, 20,028 tons of which had an average grade of $11.18, while the balance ran $9.99. There was an ore-reserve of 263,000 tons averaging $9.40 per ton and 87,000 tons averaging $6. The net earnings were $132,578, of which $108,000 was disbursed in dividends. At the annual meeting of the Cork-Province Mines, Ltd., in the Ainsworth division, it was decided to retire the present 8,250,000 ten-cent shares, and issue in their stead 1,250,000 dollar shares. With the difference the outstanding bond issue of $16,250 will be retired and the balance spent in development. Extensive improvements were made to the mill last year, including a 14-cell Minerals Separation plant, three Wilfley tables, and a boiler and heating plant. A new bunkhouse also was built. At the Standard mine, near Silverton, 20 men are employed developing a new orebody. The mill is in operation again. It is reported that the Granby company will dismantle the Grand Forks smelter. A quantity of quartzose ore that was at the smelter is being shipped to Anyox. A number of new discoveries are reported from this and surrounding districts. An orebody 5½ ft. wide and assaying 176 oz. in silver has been struck in the McAllister mine on Carpenter creek. The orebody carries a 12-in. streak of rich sulphide ore that runs considerably higher. A sample of compact sulphide ore from a 12-in. vein on the Tenderfoot claim, near Copper creek, Kamloops lake, is said to run over $1000 in gold, silver, lead, and copper combined. Ore running 6 oz. in gold and 60 oz. in silver is reported from the Gold Bug property, above Ferguson. An 18-in. vein on Mascot No. 3, near Sandon, assays from 52 to 318 oz. in silver and 50% in lead. An interesting find is reported from the Rio Tinto claim, near Nelson. An assay report gives $12 in platinum and $5 in gold.

MANITOBA

GOLD DISCOVERY EAST OF FLIN FLON.

A rich gold discovery has been made at Copper Lake lying east of the Flin Flon copper mine and about 70 miles north of The Pas, Manitoba. The original find was made some time ago by Jacob Cook, an Indian prospector, and later while examining this, J. P. Gordon, formerly chief engineer of the Hudson Bay Railway, made a further find of extraordinary richness. The vein, stated to be six feet wide, contains lumps of quartz, some of them weighing many pounds, matted by string and leaf gold which appears to form half the mass. The genuine character of the discovery is vouched for by Dr. R. C. Wallace, commissioner for Northern Manitoba, who states that he has never in his experience seen gold samples of equal richness. As soon as the discovery became known a rush of prospectors from The Pas took place and a large number of claims have been taken up. The vein has been followed for a distance of 6000 ft.

ONTARIO

REORGANIZATION OF DAVIDSON GOLD MINES.

Porcupine.—The Davidson Gold Mines is to be reorganized with a capitalization increased to $5,000,000 in shares of $1 par value and will be known as the Davidson Consolidated Gold Mines. The company's property of 120 acres will be consolidated with adjacent territory, enlarging it to 420 acres. After making this purchase and distributing to the shareholders a bonus of one share in the new company for every three shares in the original concern, a balance of 1,000,000 shares will remain in the treasury, of which 500,000 will be offered for sale at 75c. each to raise funds for development on an extensive scale.

SUSPENSION OF ASSESSMENT WORK TEXT OF JOINT RESOLUTION

Last week we noted here the passage of House Joint Resolution No. 76 suspending the annual assessment work of $100 required on mining claims, although at the time we did not have the text of the resolution at hand. This has now been received and shows that the suspension is until December 31, 1919, instead of 1920 as was first supposed. The text follows:

'Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, that the provision of section 2324 of the Revised Statutes of the United States which requires on each mining claim located, and until a patent has been issued therefor, not less than $100 worth of labor to be performed or improvements aggregating such amounts to be made during the year, be, and the same is hereby suspended during the calendar year 1919; Provided, that no such suspension shall be granted to any one claimant for more than five claims; Provided, that every claimant in order to obtain the benefits of this resolution shall file or cause to be filed in the office where the location notice or certificate is recorded, on or before December 31, 1919, a notice of his desire to hold said mining claims under this resolution.

"Section 2. That this resolution shall not be construed to alter, modify, amend, or repeal the public resolution entitled 'Joint resolution to relieve the owners of mining claims who have been mustered into the military or naval service of the United States as officers or enlisted men from performing assessment work during the term of such service,' approved July 17, 1917."

Van H. Manning, Director of the U. S. Bureau of Mines, at a recent visit in San Francisco called attention to the urgency of the oil situation in this country, and made a strong plea for American capital to enter the petroleum fields of foreign countries. He said in part:

"No other situation is so critical and so urgent in its bearing on our commerce and industry as the petroleum situation. The United States is consuming more crude-oil than it produces, and the deficit is made up by imports. Forty per cent of our natural petroleum reserves has been taken out and used. Of our coal supply we have used but 1%. And, in contrast with other nations, notably England and Holland, who control immense oil-reserves the world over, Americans have not entered the foreign field on a large scale. The only countries where American companies operate are Central and South America, Mexico, and Rumania.

"At present the United States holds the first place in the petroleum industry, and produces about 70% of the world's production. But we have to take into consideration our immense consumption, coupled with the fact, which is illustrated by the world's map of petroleum reserves, that many of the areas are now closed to us, since they are either in the possession of English or Dutch Nationals or otherwise controlled by them. In fact, it may be said that the British and Dutch nationals exercise control over all the oil-industry that is not in the hands of American companies. Unless every effort is made immediately by American capital to develop the remaining oil-reserves, the oil production of the future will be in the hands of foreign interests within a short time."

ARIZONA

Ray.—The Ray Consolidated Copper Co. has issued its report for the quarter ended June 30, 1919, showing gross income after charges of $316,365, equivalent to 20c. per share (par $10) earned on the $15,771,190 capital stock, compared with net loss of $152,298 in the preceding quarter and total income of $2,253,217, or $1.43 per share in the June quarter of 1918. Gross income after charges for the six months ended June 30, 1919, totaled $164,067, equivalent to 10c. per share on the stock as compared with $3,361,079, or $2.16 per share in the same period of 1918.

CALIFORNIA

Crescent Mills.—Control of the Crescent and Green Mountain gold properties has passed to the Philadelphia Exploration Co. Comprehensive developments have begun on both mines, which formerly ranked among the best gold producers of Plumas county.

Downieville.—Gibraltar Mining Co. has been reorganized with Jacob Keiffer, president, and W. I. Redding, secretary. The tunnel is advancing to reach the gravel channel, and a raise is being holed through to the surface to furnish air to the deeper workings.

Graniteville.—William Moore has taken the Spotswood quartz property under bond and is extending the tunnel to reach the main orebody. Good ore was found above the lateral in past years.——Driving for the vein is progressing in the W. L. Baker mine. Good ore has been mined in the upper levels and it is intended to operate the five-stamp mill as soon as the vein has been cut.

Placerville.—Under management of A. Baring-Gould operations have been resumed at Mount Hope quartz mine. A westerly tunnel on the north end of the group is 60 ft. from the portal. Old developments include a 1700-ft. tunnel and 275-ft. shaft. The equipment includes a steam and air hoist, compressor, and ten-stamp mill, all operated by water-power.——The new tunnel at Georgia Hill gravel mine has advanced 150 ft. and will probably be driven 1500 ft. to tap the channel. A compressor has been installed and quarters for miners provided.——Thomas A. Murray is arranging for increased operations at his Molybdenite group, 13 miles south-east of Placerville. Two distinct deposits have been exposed, one carrying molybdenite, the other high-grade copper.

Smartsville.—The 'Paddy' Campbell mine, known as the Blue Point, once valued at more than $1,000,000, is to be sold for $20,000, as disclosed in a suit filed by E. P. Fitzsimmons asking for the appointment of a receiver and an accounting.

COLORADO

Cripple Creek.—The El Paso Extension Mines Corporation has added to its holdings on Gold hill by acquiring control of the Lexington Gold Mining Co., owning the Clara D.,

Nellie V., Cotton Tail, and Jeff Davis No. 1 and 2, a total of 12.58 acres on Gold hill. The Clara D has produced a large tonnage of milling ore, but has been inactive for some years.——The El Paso Extension company has five sets of lessees active and producing at the Index and has recently installed a new electric compressor to furnish air for the machine-drills in use.——A 100-ft. lift in the Dexter shaft, under lease to Anderson and Benkelman, has been sunk in 18 days by C. G. Gorman and associate contractors. The Gorman interests will now cross-cut to the vein and ore-shoot on the Trail mine of the United Gold Mining Co., on which Anderson and Benkelman hold a lease that expires this fall. It is confidently expected the cost of sinking the shaft and driving the cross-cut, timbering, and cutting the station will be taken out in addition to profits before the lease expires.——G. R. Lewis, former postmaster and manager of the Copeland sampler, has been appointed superintendent of the United Gold Mines Co., a Carlton corporation controlled by the Golden Cycle Mining & Reduction Co., of which A. E. Carlton is also president. A campaign for lessees at lower royalties and better working conditions is to be undertaken. The company owns or controls about 400 acres of patented properties on Battle and Squaw mountains and Iron Clad and Bull hills in this district, now operated under the leasing system.

The orebodies recently encountered at depth in the Vindicator south-east of the shaft are holding up with development and the ore is above the average in grade. Ore from the discovery is reported shipping at between $30 and $40 per ton.——A new ore-shoot has been opened up by Charles Searles on the Jerry Johnson. The discovery was made by a raise from the eighth level. The shoot has now been proved by drift for 80 ft. in length and shipments of ore are reported to average about one ounce gold for coarse rock and two ounces for screenings.

La Veta.—On the morning of August 18 a serious explosion took place in the Oakview mine of the Oakdale Coal Co. At the time of going to press 18 men are believed to have been buried under the debris and killed. Rescue crews had recovered four bodies by night. Fume from the explosion filled the mine and several rescuers were overcome and were revived with difficulty. Owing to the wrecked condition of the mine and the gas fumes, it was considered doubtful whether the full death list could be learned for some time. Approximately 40 men were in the mine when the explosion occurred, including Fire Boss William Christopher. Ten men escaped through the main stope after the explosion, and ten others made their way to the surface through an adjoining mine. William Davis, a miner, one of those overcome by the explosion, recovered sufficiently to make his way to the surface. None of the others have been heard from. The explosion took place about a mile and a half from the portal.

IDAHO

Beaver Creek.—The Red Monarch Consolidated Mining Co. is praparing to resume operations on its property, according to an official. Dan M. Drumheller, Jr., a mining engineer, has been appointed superintendent, and has gone to the property. A crew of 10 to 15 men will be employed at the outset.

Big Creek.—High-grade silver ores found in the Big Creek district are attracting unusual attention and several well-organized prospecting expeditions have recently gone into that section to explore some of the iron-capped lodes. Two shipping mines are now in active operation, the Big Creek Leasing Co., operating the Yankee Boy, and the Big Creek Mining Co., both making regular shipments of high-grade ore, part of which is gray copper containing from 300 to 500 oz. of silver per ton, according to reports from that district.

Kellogg.—The Caledonia Mining Co. had a surplus of $624,010 on June 30, according to a report from S. A. Easton, the president. This is an increase of $198,618 over the surplus December 30 last. The dividends paid in the first six months of the year aggregated $156,300.

Murray.—Satisfactory results are attending operations of the Bear Creek Mining Co., according to Patrick Burks, the president. The mill is handling ore and the movement of concentrate to the railroad is expected to begin soon.

Porthill.—The Idaho-Continental mine is in full operation with a total complement of 130 men in all departments. The operators have been shipping 60 tons of concentrate daily since the roads became solid enough to haul ore over, which was on July 22. They are using 12 motor trucks between the mine and the railroad at Porthill.

Wallace.—A walkout of practically all the miners of Burke, Mullan, and Nine Mile districts of the Coeur d'Alene occurred on August 15 following a vote by members of the International Union of Mine, Mill and Smelter Workers. More than 1500 miners are out as a result of the strike, which was called against the advice of the international representatives of the union and in spite of the efforts of Robert M. Wade, federal mediator. The men demand an eight-hour day "from portal to portal"; increase in their wages from $5.25 to $5.75; and recognition of the union.

This strike was preceded by a small one the day before at the Interstate-Callahan, when 100 employees walked out. A meeting had been held and a committee appointed to wait upon Manager Newton and demand six hours per day "from portal to portal" and $1 per hour for this abbreviated shift. The committee, however, seems to have lacked the courage to present this demand in person, so the information was conveyed to the manager in a note left where he would be sure to find it. Neither did they wait for a formal reply to the demand, probably and very properly assuming that it would be promptly denied. Without hearing from the management 100 employees drew their time this morning and came down the hill. This action, which was entirely independent of the miners' union, indicates that the Interstate-Callahan had inadvertently gathered in a goodly number of 'wobblies' while recruiting a force to resume operations.

MICHIGAN

Houghton.—Production of refined copper from the Calumet & Hecla and subsidiary mines for the month of July was 6,207,519 lb. The output by mines follows:

	Pounds
Ahmeek	958,500
Allouez	150,100
Calumet & Hecla	3,292,821
Centennial	76,002
Isle Royale	935,150
Osceola Con.	651,000
Superior	35,025
White Pine	95,444

The most impressive increase in July over June was made by Isle Royale, which showed an increase in output of nearly 50%.

NEVADA

Ely.—Emmet D. Boyle, Governor of Nevada, has gone to Salt Lake City for a conference with R. C. Gemmell, general manager of the Utah Copper, respecting the strike situation at Ely, in which employees of the Nevada Consolidated Mining Co. and Nevada Northern Railroad Co., associated interests, are involved. Governor Boyle conducted a personal examination of the strike situation at Ely and then went directly to Salt Lake City to lay the matter before officials of the Utah Copper Co. with a view to bringing about an amicable adjustment.

McGill.—The report of the Nevada Consolidated for the quarter ended June 30 shows a production of 11,149,362 lb. of copper, compared with 12,201,444 lb. in the previous quarter. The net profit was $184,778, compared with a loss of $111,159 in the quarter ended March 31.

The report says in part:

During the quarter 568,525 dry tons of ore of an average grade of 1.42% copper was treated, as compared with 529,692 dry tons averaging 1.79% copper for the previous quarter. No customs ore was offered for treatment during the quarter. The cost of production per pound of copper, including charge for depreciation of plant and equipment but without credit for gold and silver and miscellaneous earnings, was 18.07c. per pound. The value of gold and silver recovered and the miscellaneous earnings for the second quarter amounted to 4.61c. per pound of copper. The costs for the preceding quarter, calculated upon the same basis, that is, including charge for plant depreciation and the fixed and general expenses, but excluding credit for miscellaneous earnings, were 16.85c. per pound of copper. The credit for miscellaneous income for the first quarter, including gold and silver recovered, was 2.34c. per pound. The operating income upon which the earnings for the quarter are based is computed at 15.12c. per pound of copper, as compared with 13.6c. per pound for the preceding quarter. This slight increase in the carrying price is due to the fact that the sales of copper during the quarter were increased to some extent, all unsold copper being carried as usual at 13.5c. per pound. The actual sales of metal for the quarter, however, did not equal the production for the period, which resulted in a further increase of unsold copper on hand and in transit. A general improvement in industrial conditions at this time would seem to indicate a slow but gradual increase in domestic consumption and a decided stimulation of foreign demands. While this fairly well defined improvement in the copper market gives promise of further expansion, the management has considered it advisable to continue the output of copper on the present basis of curtailment until some portion of the company's accumulation of copper stocks can be marketed to advantage.

NEW MEXICO

Hurley.—The report of the Chino Copper Co. for the second quarter of 1919 shows an operating profit of $44,031 and a deficit after dividends of $282,069. Production for the three months amounted to 10,541,000 lb. of copper compared with 11,512,133 lb. for the previous quarter. The total amount of ore treated for the three months was 401,100 tons, equivalent to an average of 4408 tons per day, or 1083 tons less than that milled for the first quarter of 1919. The average assay in copper was 1.83%, compared with 1.80% for the first quarter of 1919. The ore milled during the second quarter was considerably more favorable to concentration than that treated during the previous quarter. The recovery per ton of ore milled for the quarter was 26.28 lb. of copper, as compared with 23.29 lb. for the first quarter of 1919. The cost per pound of net copper produced from milling operations for the second quarter, after allowing for smelter deductions and including depreciation, was 14.16c. as against 15.03c. for the first quarter of 1919. The cost figures do not include any charge for Federal income excess-profits taxes, nor do these costs take into consideration miscellaneous income. There were no gold and silver credits from the concentrate produced during the second quarter. The above figures are based on a carrying price for copper of 14.60c. per pound for the second quarter of 1919, which was calculated in the usual manner by inventorying all unsold copper at 13½c. per pound. The figures for the first quarter of 1919 were based on a price of copper of 13.04c. per pound.

PERSONAL

Note.—The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

A. N. Mackay is in Colombia.

A. H. Ackerman is in Transylvania.

Arthur L. Pearse writes from Atlantic City, New Jersey.

C. V. Corless has left Coniston, Ontario, on a visit to England.

F. W. Bradley is on his way between Fairbanks and Juneau.

Courtenay De Kalb is expected in New York on his return from Spain.

H. A. Titcomb is leaving England to take up his residence in New York.

Louis A. Wright is returning to New York, after a couple of months holiday in California.

Morton Webber has returned from Mexico and is now at the Empire mine, at Mackay, Idaho.

H. A. Guess, of the A. S. & R. Co., has been examining properties in the Portland Canal district.

A. W. Grierson has been appointed manager for the Kirkland Combined Mines, at Kirkland Lake, Ontario.

S. G. Blaylock became general manager for the Consolidated Mining & Smelting Co. of Canada on August 1.

J. Parke Channing will attend the Industrial Conference at Silver Bay, Lake George, New York, on August 29.

L. J. Mayreis and **W. R. Degenhart** have arrived in London from the Bawdwin mine of the Burma Mines company.

Charles F. Hazelton, on his return from France, where he served with the 27th Engineers, has gone to Victor, Colorado.

E. H. Clausen has returned from New York to San Francisco and is going to Caliente, California, to take charge of the Zenda mine.

William J. McBride, chief metallurgist to the Broken Hill South Co., of Broken Hill, passed through San Francisco on his return to Australia.

Reginald E. Hore has resigned the editorship of the 'Canadian Mining Journal', and is succeeded by **F. W. Gray,** formerly Associate Editor.

W. A. Meloche, who served with the 115th Engineers, has returned from France and is now on his way to the Hazelton district of British Columbia.

A. H. Jones has resigned as mill superintendent for the Tonopah Belmont Development Co., to join the Butters Filter Co., at Salt Lake City.

H. H. Yuill, Colonel, D. S. O. and M. C., recently Controller of Mines in the B. E. F., has joined the firm of Bainbridge, Seymour & Co., in London.

Rene J. Mechin has resigned as engineer to the Nacozari Consolidated Copper Co., to accept a position as engineer with the Santa Gertrudis company at Pachuca, Mexico.

H. W. Stotesbury, after 12 years service, has resigned as engineer and superintendent for the Tonopah Mining Co., and will establish himself in consulting practice at Los Angeles.

Harold N. Lawrie, chairman of the Board of the Oregon Bureau of Mines and Geology, has accepted the active chairmanship of the Division of Precious and Rare Metals in the American Mining Congress.

Van H. Manning, Director of the U. S. Bureau of Mines, was in San Francisco last week. On August 15 he was entertained at the Engineers Club and delivered an interesting address on the activities of the Bureau.

THE METAL MARKET

METAL PRICES

San Francisco, August 19

Antimony, cents per pound	30 — 40
Aluminum, cents per pound	10 — 40
Copper, electrolytic, cents per pound	23.50
Lead, cents per pound	6.35
Platinum, per ounce	$105
Platinum, per ounce	$1 71
Quicksilver, per flask of 75 lb	$105
Spelter, cents per pound	9 75
Zinc dust, cents per pound	11 00 — 14.50

EASTERN METAL MARKET

(By wire from New York)

Aug. 19—Except in those cases noted below, there is little change to report in the metal markets from a week ago. Interest continues to be centered in the copper situation, which is the most active and strongest metal on the list.

SILVER

Below are given official or broker quotations in cents per ounce of silver 999 fine. From April 23, 1918, the United States government paid $1 per ounce for all silver purchased by it, fixing a maximum of $1.01½ on August 15, 1918, and will continue to pay $1 until the quantity specified under the Act is purchased, presently extending over several years. On May 5, 1919, all restrictions on the metal were removed, resulting in fluctuations. During the restricted period, the British government fixed the maximum price five times, the last being on March 31, 1919, on account of the low rate of sterling exchange, but removed all restrictions on May 10. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the normal rate of exchange.

Date	New York cents	London pence		Average week ending	Cents	Pence
Aug. 13	112.87	58.87	July	8	107.52	53.47
14	113.00	58.87	"	15	106.75	53.38
15	112.75	59.00	"	22	104.85	54.25
16	112.62	59.37	"	29	106.14	54.99
17 Sunday			Aug.	5	108.08	55.17
18	112.62	59.37	"	12	110.58	58.02
19	112.25	59.37	"	19	112.68	59.14

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	75.14	88.72	101.12	July	78.92	99.62	106.36
Feb.	77.54	85.79	101.12	Aug.	85.40	100.31	...
Mch.	74.13	88.11	101.12	Sept.	100.73	101.12	...
Apr.	72.51	95.35	101.12	Oct.	87.38	101.12	....
May	74.61	99.50	107.23	Nov.	85.97	101.12	....
June	76.44	99.50	110.50	Dec.	85.97	101.12	....

COPPER

Prices of electrolytic in New York, in cents per pound.

Date		Average week ending		
Aug. 13	21.50	July	8	18.53
14	21.75	"	15	20.29
15	22.00	"	22	21.50
16	22.50	"	29	23.50
17 Sunday		Aug.	5	22.87
18	23.00	"	12	22.20
19	23.25	"	19	22.33

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	29.53	23.50	20.43	July	29.67	26.00	20.82
Feb.	34.57	23.50	17.34	Aug.	27.42	26.00	....
Mch.	36.00	23.50	15.05	Sept.	25.11	26.00	....
Apr.	33.18	23.50	15.23	Oct.	23.50	26.00	....
May	31.69	23.50	15.91	Nov.	23.50	26.00	....
June	32.57	23.50	17.53	Dec.	23.50	26.00	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound:

Date		Average week ending		
Aug. 13	7.60	July	8	7.45
14	7.70	"	15	7.74
15	7.85	"	22	8.17
16	8.00	"	29	8.32
17 Sunday		Aug.	5	7.94
18	8.00	"	12	7.64
19	8.00	"	19	7.86

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	9.75	7.78	7.44	July	8.98	8.72	7.78
Feb.	10.45	7.97	6.71	Aug.	8.58	8.87	....
Mch.	10.78	7.67	6.53	Sept.	8.33	9.58	....
Apr.	10.20	7.04	6.49	Oct.	8.32	9.11	....
May	9.41	7.92	6.43	Nov.	7.76	8.75	....
June	9.63	7.92	6.91	Dec.	7.84	8.49	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed by the open market according to quantity. Prices in dollars per flask of 75 pounds:

Date		Aug.		
July 22	100.00	"	5	105.00
" 29	100.00	"	12	105.00
Aug. 1	100.00	"	19	105.00

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	81.00	128.06	103.75	July	102.00	120.00	100.00
Feb.	106.25	118.00	90.00	Aug.	115.00	120.00	...
Mch.	113.75	112.00	72.80	Sept.	112.00	120.00	...
Apr.	114.50	115.00	73.12	Oct.	102.00	120.00	...
May	114.00	110.00	84.80	Nov.	102.50	120.00	...
June	85.50	112.00	94.40	Dec.	117.42	115.00	....

LEAD

Lead is quoted in cents per pound, New York delivery.

Date		Average week ending		
Aug. 13	5.60	July	8	5.40
14	5.60	"	15	5.42
15	5.65	"	22	5.62
16	5.75	"	29	5.91
17 Sunday		Aug.	5	5.87
18	5.75	"	12	5.64
19	5.75	"	19	5.68

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	7.64	6.85	5.60	July	10.93	8.03	5.53
Feb.	9.10	7.07	5.13	Aug.	10.75	8.05	...
Mch.	10.07	7.26	5.24	Sept.	9.07	8.05	...
Apr.	9.38	6.99	5.05	Oct.	6.97	8.05	...
May	10.29	6.88	5.04	Nov.	6.38	8.05	...
June	11.74	7.59	5.32	Dec.	6.49	6.90	....

TIN

Prices in New York in cents per pound.

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	44.10	85.13	74.50	July	62.60	93.00	70.11
Feb.	51.47	87.00	73.44	Aug.	62.53	91.33	...
Mch.	54.27	85.00	72.50	Sept.	61.54	80.40	...
Apr.	57.63	88.53	72.50	Oct.	62.24	78.82	...
May	63.21	100.01	72.50	Nov.	74.18	73.37	...
June	61.93	91.00	71.83	Dec.	85.00	71.52	....

ORES

Tungsten: The market has been lively in the past week, and for the first time in many months business has been done in Bolivian wolframite of high grade at $10 per unit. Inquiries are more numerous. For spot ore buyers and sellers cannot get together on price. Chinese ore is quoted at $7.75 to $7.50 per unit. There appears to be an understanding that the Central Powers cannot buy ore, except with the permission of the Economic Council, and representatives of the trade have written B. M. Baruch on the subject. Verbally Mr. Baruch replied there is no objection to trading with the Central Powers, and that the Council has jurisdiction only on the credit end or the exportation of gold in payment.

Molybdenum: The market remains dull with quotations ranging from 75 to 80c per pound of MoS₂ contained.

Chrome Ore: More demand is reported for ore, the quotation for which is $25 per ton f. o. b. California, common point, or 80c per unit delivered Pennsylvania plant.

Manganese-Iron Alloys: The chief feature of the week is the sale of 2000 to 3000 tons of English ferromanganese at a price under $105 seaboard which was recently quoted and believed to have been about $100. Domestic producers can be depended to meet the foreign makers' price as they have done heretofore. Representatives of the English makers say they did not name the new low price, but accepted a firm offer made to them by consumers.

Spiegeleisen is strong at $35 for 18 to 20% material.

FOREIGN EXCHANGE

During the week sterling, francs, and lire all declined steadily without notable rallies, establishing new low records. The most pronounced weakness was in the Continental rates, especially lire. It should be remembered that the low for lire during the War was 9.15. At 9.25 the lire has a value of 10.8c. in U. S. currency against a normal of 19.3c., a discount of 44%. Meanwhile, the Germans are reported to be endeavoring to bolster the mark a little by requiring that marks to the credit of foreign exporters must remain in German banks for a year, amounting practically to an involuntary grant of credit. Were it not for such tactics it is surmised that the mark would be quoted under its present record low of 5.25c., which compares with a normal of 23.8c., a decrease of 78%. Some Germans are reported to be evading the new rule by paying cash for much needed materials, while on this side bankers are refusing to buy commercial bills unless guaranteed against the one-year tie-up.

Quotations on August 19 are as follows:

Sterling	Cable	4.22
	Demand	4.21½
France	Cable	7.95
	Demand	7.97
Lire	Demand	9.25
Marks		5.25

Eastern Metal Market

New York, August 13.

The general situation in metals is one of quiet, with the producers of copper, lead, and zinc sitting back and letting second-hands take what small business is stirring. The makers quite generally are holding firmly to their prices, the concessions all coming from second hands.

Copper is lower, but is now showing a slightly more favorable trend.

The nominal quotation for spot tin—70c.—has about been eliminated because of the arrival of shipments from abroad. In the first half of August several hundred tons arrived, with more in sight, and free trading will be resumed August 15.

The leading lead interest adheres to 6c., New York; outsiders are quoting down to 5.60c. in a dull market.

Spelter is quiet but fairly firm, with several producers still out of the market.

Antimony is a little lower.

IRON AND STEEL

Labor troubles are seriously hampering steel production in some sections, the railroad shopmen's strike in particular hitting South Chicago and Gary, Indiana, hard. In these districts blast-furnace operation has been reduced, with consequent lessening of activity on the part of steel mills. At Cleveland, with the same cause, the American Steel & Wire Co. is idle in all departments. On the Lakes, the movement of ore has been stopped by a strike at upper Lake docks, the men wanting a 30% advance in wages. The unionization of steel-plant employees is being conducted with vigor, but not much fear is entertained of the result in this direction. The movement, however, is not being overlooked. Southern (Alabama) pig-iron is stronger, several makers advancing their base price 50 to 75c. per ton. The general tendency among the producers of steel is not to advance their prices, but here and there some products have advanced, as in galvanized sheets, nuts, bolts, and rivets, and boat spikes and cut nails. Steel-ingot production in July was 2,984,856 gross tons, the daily rate increasing to 114,802 tons, as against 105,639 tons per day in June, an increase of 8.7%. The July output was at the rate of 35,000,000 tons per year, or 17% less than the average for last year.

COPPER

In a dull market prices pursued a downward tendency in the week, the declines recorded being traceable more to sympathy with the London market than to any other cause. This week, however, the London market has become firmer. Another strengthening influence has been the better tone of the stock market, which broke badly last week. The large consumers of copper are well supplied with the metal, and producers see no reason why they should recede from their quotations of 23.50 to 24c. for electrolytic. Second-hands have been the factors which quoted the lower prices, there being reports of offerings yesterday as low as 21c., although 21.50c. is probably nearer the market. Lake has not declined proportionately and is held around 22c., but is scarce. Aside from the filled-up condition of consumers a further influence making for a quiet market lies in the many uncertainties in costs of labor, fuel, and freights. Good news from Rome, New York, is that the copper and brass companies there have settled their difficulties with their men and the latter have returned to work. Exports are expected to increase in volume in the near future. The Bureau of Foreign and Domestic Commerce has issued a statement saying that 19,842,478 lb. of unrefined black blister and converter copper in bars, pigs, or other form was imported in June, and that 24,250,659 lb. of refined copper and ingots, bars, or other forms was exported. Of copper wire, other than insulated, 4,766,354 lb. was exported in the same month.

TIN

In the near future there will be a change in the nominal price of 70c. for spot Straits tin. Free trading will be resumed August 15, and the market already feels the effect of recent arrivals of the metal and the near arrival of still more. Since August 1, 350 tons of tin has arrived, and at least three ships are due, each of which is bringing tin. As the availability of the tin afloat comes nearer it is certain that its price and that of actual spot metal will draw closer together until the two strike a compromise. On August 11, October delivery at the East was quoted at 52.25c.; November from the East at 52c.; and afloat from England at 54.40c. September to December shipments from the East were offered at 51.75c., Lamb & Flagg for prompt shipment at 51.50c., and Straits, September shipment from England, at 53c. The price situation is unsatisfactory with such a range as has existed, to say nothing of being puzzling to many, and the restricting of prices to narrower ranges will be welcomed. From March to July, inclusive, no tin arrived at United States Atlantic ports, and but very little in the first two months of the year. In those months large government stocks were available at fixed prices, and under restrictions.

LEAD

Not much can be said about the lead market in comparison with conditions of a week ago. Second-hands continue to dominate the market, their New York quotation being around 5.60c., New York, some independents quoting higher. The leading interest continues to quote 6c., New York. At St. Louis the weakness is not so pronounced. As in copper, the large consumers are well supplied, and the leading producer is apparently content to leave the market to outsiders, and, it is believed, will continue to pursue this course for the time being. It is reported that Government stocks of lead, which totaled 30,000 tons January 1, have been reduced to about 3000 tons, as of August 1, the remainder having gone into consumption.

ZINC

Makers of zinc are not pressing for sales, and the market has pursued a fairly steady course, despite quiet. Some of the large producers continue out of the market, the plants of some being down. Prompt was quoted August 11 at 7.60c., New York. Exports of zinc in June (in pigs, slabs, etc., produced from domestic ore) totaled 18,489,575 lb., France taking 9,406,822 lb., England 5,247,759 lb., Belgium 1,691,200 lb., and Italy 1,377,113 lb. These figures are given by the Bureau of Foreign and Domestic Commerce.

ANTIMONY

Quotations are lower, spot now being quoted at 9c., New York, duty paid. No business worthy of note is reported, except that the bulk of the Government's surplus stock of antimony has been sold, a Chinese buyer taking most of it.

ALUMINUM

The market for 98 to 99% pure virgin metal is about 32c., bidders offering 31c., while the leading interest asks 33c. Some French aluminum which was offered at 31c. has been absorbed, and higher prices are being asked for future deliveries from that source.

WE publish a humorous exchange of letters with the manager of a mine at Jos, in Northern Nigeria. Obviously it ought to be spelled 'Josh', but the reader will not mind that. The troubles of our friend in western Africa are not unlike those of mine managers elsewhere, therefore the incident will call for amused sympathy.

DR. COUDEN, the blind chaplain of the House of Representatives, has been 'called down' by the Speaker, a Republican, for mentioning the League of Nations favorably when addressing the Deity. It is not said whether it was feared that his prayer might cause a schism in Heaven, or that the powers above, not understanding domestic politics, might be misled, or that the courts on high had signified their reprobation of entangling alliances.

IN a speech made before the Commercial Club in San Francisco, Dr. Butler, the president of Columbia University, referred to the expansion of currency as a prime factor in raising the cost of everything. He stated that in 1907 the currency of France was 7½ billions, whereas in 1919 it had increased to 40. In the United States the circulation of money in 1881 was about $20 per capita; in 1901, it was $30; in 1914, $40; and in 1919 it was about $50.80. The newspapers that recorded his interesting speech also described the railway strike at Los Angeles and made mention of the loss of perishable merchandise, especially fruit, caused by the stopping of local traffic. Strikes represent an important element in raising costs, because they involve not only wastage of perishable commodities, but a cessation of productive labor.

SENATOR PHELAN wants the Governor of California to call a special session to pass a law prohibiting the foreign ownership of oil-lands in this State, while he is protesting against the plans of the Mexican government to confiscate the oil properties owned by our nationals in Mexico. On another occasion he undertakes to tell Great Britain how to manage the Irish, while the negro problem in the United States is taxing not his best thought, it may be, but that of his colleagues in the Senate. Thus does the ache for notoriety drive legislators into laughable inconsistencies. A sense of the ridiculous might save them from foolishness. Incidentally, we note that according to official figures issued by the Mexican government, the British group headed by Lord Cowdray and now controlled by the Royal Dutch-Shell combination has acquired 2,431,000 acres of oil-land in Mexico, whereas the Doheny American group has acquired 586,692 acres, out of a total of 5,436,271 acres now in the hands of foreign corporations.

ATTENTION is drawn by the 'Manufacturers Record' to an affidavit of Mr. Harry O. Tucker, quoted before the Ways and Means Committee of the Senate, in which this traffic manager for the American Trona Corporation testifies to the fact that Herr Paul Freundrichsen, propaganda manager for the German Kali Syndicate, told him and others that the Trona Corporation was "foolish and unwise to invest money in a potash reduction enterprise in the United States for the reason that the German Kali Syndicate and the Imperial German government would after the conclusion of the War absolutely destroy the American potash industry by marketing the German potash in the United States at such low figures as to absolutely preclude and bar any and all competition." This sort of thing was said several times three or four months before the United States entered the War. The affidavit is dated February 7, 1919.

GEORGE ADE tells the story of a young man who was kicked in the head by a mule and "thereafter believed everything he read in the Sunday newspapers." In that weekly scrap-book the 'Literary Digest' we read a quotation from the Springfield 'Republican' in which existing conditions in Mexico are said to resemble the crisis in the Transvaal before the Boer war, "when the prize was the possession of the new gold mines of South Africa". The Springfield 'Republican' is one of the best newspapers in the country and we wish there were more like it; therefore we are all the more surprised to see this old myth revived in such intelligent quarters. We know something about the mines of the Transvaal and their ownership, as most mining engineers do, and we can say that the ownership of those mines was vested in the stockholders of the companies that operated them before the Boer war, and after it; and those stockholders were chiefly British, German, and French, but while the British held the majority they did not hold the plurality of the shares. If the same stockholders are not in possession now it is not on account of the Boer war but

because the controlling financial houses, chiefly of German-Jew origin, sold to the public while the quotations were still inflated by fictitious prospects of indefinite persistence of ore in depth.

SHOULD one keep faith with a bandit? An agreement had been made to pay $15,000 as ransom for the two aviators captured by the Mexican bandits near Candelaria and the money was taken to a specified spot by Captain Leonard F. Matlack. He paid half the money and then contrived to escape with the remainder, together with the two captives. As he rode off he shouted to the bandits "You can go plumb to hell!" It is stated that General Dickman "instructed officers at Candelaria to pay the Mexican bandits the full $15,000 as stipulated in the agreement made with them by the United States government". We salute the General. He is right, of course. It is as necessary to keep faith with a bandit as with a bishop; more especially should officers of the Army and representatives of the Government keep their word, no matter who may be the party of the second part. Have you heard of the War Minerals Relief affair? Let us play the game, even if the other fellow deals from the bottom of the pack. Moreover, there is a good practical reason for carrying out an agreement of this kind with bandits, in Mexico or elsewhere. The next time they capture one of our friends, it may prove impossible to ransom him because of our breach of faith or it may be that the bandits, imitating our smart tactics, may seize the messenger with the money and retain both it and the captive. An honest man loses his main advantage over a crook when he disregards, even momentarily, the obligations of his own code.

THE trial of the Elm Orlu v. Butte & Superior case was concluded on August 25, having lasted four weeks. It was remarkable for the elaboration of testimony. Plaintiff was represented first by Mr. Rush J. White, the engineer that has had charge of development work underground during the last three or four years; then came Mr. Fred Searls, Jr., a brilliant young geologist from San Francisco; he was followed by Mr. James F. Kemp, who needs no introduction, and then by another eminent geologist, Mr. Charles K. Leith, after whom came Mr. William B. Fisher, a mining engineer who testified as a practical miner. The sixth and last witness for the Elm Orlu was Mr. Horace V. Winchell, the president of the Institute. On the other side, that veteran expert and distinguished mining engineer Mr. Walter H. Wiley opened for the defence; he was followed by Mr. Samuel Barker, who has had charge of development work for the Butte & Superior; then came Mr. W. H. Emmons, the author of 'The Principles of Economic Geology', and after him Mr. Carl Hahn of Los Angeles. Our friend Mr. Alfred Burch was the next to testify and Mr. Darcy C. Bard, formerly professor in the Butte School of Mines, but now at Seattle, completed the testimony. These gentlemen have differed on the interpretation of facts, rather than on the facts themselves. Each mine has 12 levels, which overlap, one set being uniformly 40 feet below the other, so that 24 levels and numberless cross-cuts have to be examined and considered by the witnesses. Six miles of drifts are involved. There are ten raises from 500 to 1200 feet long, making about a mile and a half of vertical openings that have to be carefully scrutinized in search of clues to the structural geology of the ground under dispute. Unusual complexity of vein-intersections and fault-crossings have taxed the powers of observation even of men trained by experience to diagnose such conditions. A large proportion of these miles of workings was excavated for the purpose of the contentions presented by the litigants, and the other expenses incurred in the course of the litigation have been very heavy. We hope that the science of geology may be the gainer, and we would like to be told that the exploratory work done for litigious purposes had led, as in other Butte lawsuits, to the exposure of unsuspected orebodies.

IN a Utah newspaper we found an article intended apparently to boost Cherry Creek, an old mining settlement in Nevada that has been revived by the increased demand for silver. The local scribe, filled with enthusiasm, and nothing else, for Utah is now a part of post-prohibition aridity, became so bemused by his exuberance that he mixed his metaphors irretrievably. The article begins: "Demand for silver has become the modern Moses of many a Western State and with its staff of high prices has struck the rock in Nevada from which an abundance is beginning to flow. Back in the days of good silver prices many a town boomed into a city in the sagebrush state. Stages filled with investors flitted in and out of these places, trekked wearily over the desert wastes, stopping at night in sumptuous palaces of hospitality, surrounded by life intense, keyed to its highest pitch, where great engines on the hillside fairly bellowed animation, mills roared over their rich harvest of metal and money was as liquid as the beverage it bought and the roulette wheels that it set moving smoothly. It was a chapter in western history such as may never be repeated. Then followed the blight of low prices." Imagine a demand having a staff wherewith to strike the rocks of Nevada; stages so light and airy as to flit in and out of the booming cities of the sagebrush plain; great engines that bellowed like buffaloes and mills that roared like mountain lions; money liquid as roulette-wheels; and the blight that fell on these multifarious activities like the muffler on a boisterous exhaust. As our chronicler says: "It was a picture of darkest desolation." But from the darkness of this industrial death—we venture to proceed to say—there emerged the radiance of a new day when Cherry Creek, effulgent in the dawn, arose above the Lower Carboniferous limestone of the lower earth and hurled its victorious challenge at the stars, to the plaintive accompaniment of the wandering coyote and the cheerful chorus of the pollywog, whose anthem of rejoicing fell upon the awakening world like the first stroke of a master-hand upon a grand piano, and so forth *ad nauseam*.

High Costs

Agitation against the cost of living continues. Each day the press contains new accounts of hoarded food-stuffs seized by officials acting for the Department of Justice. What proportion of these seizures is really hoarded, in the sense of vast stocks deliberately withdrawn from the market to create an artificial scarcity and corresponding high prices, and what proportion is merely laid by in time of plenty with the legitimate purpose of use in time of scarcity, is difficult to determine at present on account of the popular clamor. There is the story of the Californian bean-growers, who, in 1918, in response to the call for food production, started to produce beans intensively for the Government. When warfare ceased the Government stopped buying beans, whereupon the abnormal demand ceased and the market collapsed. The Californian producers were over-loaded with beans, they stored them in the hope of better prices, and in due course these hoards were 'discovered' and 'denounced'. Other examples could be quoted. The people are in an irritable mood, and doubtless in their wrath and ignorance of the problem of marketing some of the more perishable food-stuffs, the epithet 'profiteer' is applied to many who do not deserve it. Yet, from a sifting of the present rather unsatisfactory evidence, it seems fairly clear that much of the hoarding is not legitimate, but is done for the purpose of selfish gain at the expense of an already sorely tried people. The position of hoarders of that type is none too secure. Although on small issues partisan politics and petty graft usually transfer the real control of this country from the people to the leaders of the various political factions and machines, on large issues the people still rule, as many are likely to learn to their sorrow. When sufficiently stirred throughout the country, as the increasing cost of living has stirred them, the people are quite capable of raising an uproar that will rattle the windows of the Capitol at Washington and force through in record time any legislation that pleases them; and in that case the position of food-hoarders who cannot show a clean bill of health is likely to be made exceedingly unpleasant. But there is another side to this complicated and troublesome business. Much of the present abnormal cost of living is the result of diverting the agencies of production to destructiveness during the four years of the War. It should not be forgotten that money is nothing more than a medium of exchange, a convenient yardstick by which the product of one man is measured in terms of the product of another. True prosperity, that is, the condition where the conveniences and luxuries of modern life can be enjoyed by the many instead of the privileged few, can result only from the production being great enough to give everybody a share. This is the true measure of the cost of living: the amount of produce, in its larger sense, that people can exchange with each other. An unfair valuation of the labor of a small group, namely, the payment of wages disproportionately low, can deprive that group of some of its share; the vast credit system by which modern business is transacted can work damage to individuals when the value of money fluctuates; the deliberate destruction of supplies—or hoarding them until they spoil—can reduce the small supply available and aggravate an already serious situation. These are grave matters that must be adjusted for the peace and happiness of the nation, but we should not forget that, compared with the fundamental factor of the quantity of goods produced, they are really only on the surface of things. Popular clamor that hurls itself at the minor issues instead of the underlying cause is like the physician who treats only symptoms while his patient grows steadily weaker under the ravages of some deep-seated illness. We have been glad to observe lately a tendency on the part of Labor to recognize this fact. We hear fewer objections to labor-saving machinery and to methods of increasing production. Labor seems to be realizing slowly that it is not a commodity in the sense that potatoes or meat is a commodity; that although the money that it receives for work may be governed by the laws of supply and demand, the goods that it can obtain in exchange for this money, which is the true measure of wages, increases only as the productiveness of Labor increases. In terms of money this simply means that if Labor is producing more than it demands for happiness and contentment, wages go up faster than the price of commodities; if Labor is producing less than it demands, the price of commodities—namely, the cost of living—goes up faster than wages. That is the present condition, and every strike, every increase of wages without corresponding increase of productiveness, only adds to the trouble. The situation now is further complicated by the masses in Europe who are as yet only consumers, which, being translated again into terms of money, means that the export of commodities for high prices increases the cost to those of us at home at the same time that it decreases the supply, without any corresponding gain in the import of those commodities that Europe makes particularly well. The true barter is labor for labor, goods for goods. Money is merely a convenient medium of exchange, and no amount of price-fixing or prosecution of profiteers and hoarders can alter this fundamental fact. These measures, if intelligently applied, can do much to alleviate the present situation, but they can never cure it. To do that it is necessary to strike at the root by stimulating production. We wish that the present outcry, which may, before it is done, prove well-nigh irresistible, could be thus directed on essentials instead of spending its valuable energy upon what must remain only a phase. If organized labor, while fighting for its idea of a square deal, could but see the issue clearly enough to direct its tremendous power to the increase of production, instead of to comparatively local squabbles over wages and strikes that but make matters worse, we might hope for a speedy betterment of conditions. We think we can see indications of this; hazy as yet, perhaps, but still forerunners of better things. In the re-organization of our industries that is taking place Labor will inevitably obtain a more equitable division of the profits. It will

have a greater part to play in the management, a greater responsibility, and with these will come a more sober judgment and a broader vision. The true economics of prosperity will be seen more clearly; methods of increasing production will no longer seem antagonistic to its best interest; more work instead of less work per man will be its slogan. In that direction lies our hope.

Mexico Again

The alarums and excursions on the border, accompanied by the cheap melodrama of sundry aviators and their rescuers, have again thrown the searchlight of publicity upon the misgovernment of our southern neighbor. It is announced that a Mr. Wallen, photographer for Hearst's International Film Service, took 800 feet of motion-pictures; so the latest military expedition has not been unfruitful. The more significant event, however, is the statement issued by Señor Carranza in an interview published in the 'Nation' on August 20, at the very moment when a punitive expedition was hot on the trail of the Candelaria bandits and international relations were in danger of violent rupture. The head of the Mexican government announced: "Our relations with the United States are better each day. Having passed through the period of the War, the American people are now convinced that we remained actually neutral during an epoch when it would have been to Mexico's advantage to enter the world war." Such a lack of humor verges on criminality; Don Venustiano had better refrain from giving expression to the sentiments of the American people and confine himself to enunciating the views of his own clique in his own distressful country. If he had been fool enough to take part in the War, by giving active assistance to Germany, the result would have been slightly disadvantageous to Mexico—indeed Señor Carranza might have found himself in a position of more ease and less responsibility, either in this world or in another where the climate is *muy caliente*. In the same interview, fitly published in Mr. Oswald Villard's paper, Carranza asks for the free importation of arms from the United States into Mexico and says that an expenditure of 150,000,000 pesos would be required to maintain an army large enough to pacify the country. Presumably he expected to obtain the money, with the arms, from the United States. Whether we should lend money to a gentleman that thinks we ought to be grateful to him because he did not join our enemy recently in waging war against us, is a point we leave to the Secretary of State, but as to the selling of arms to him, there can be no doubt. It is this very supplying of guns and ammunition to the Mexicans that has contributed to the prolongation of their social disorder. Not only have Carranza's so-called generals fattened themselves financially out of his treasury, but they have gone so far as to sell arms to the parties of brigands that have kept Mexico in a state of turmoil. As things are, we can never tell to what extent the arms permitted to enter Mexico today will be used against us tomorrow. It is quite evident that Carranza, from our point of view, is utterly untrustworthy, for his pluming himself on not having taken active part with the Germans against us during the War is a fair sample of his way of thinking. He is a tricky adventurer in the hands of an unscrupulous gang of half-military half-brigand half-breeds utterly unable to consolidate whatever patriotic sentiment may survive in Mexico. The most promising news that has come from across the Rio Grande recently is the anxiety shown by the newspapers of Mexico City and the protestations of loyalty to their Government offered by various associations of railway workers. Moreover it is announced that two political organizations of some importance, the Unionist Political Association and the Liberal Alliance, "have united to bring about peace in Mexico" and have called a meeting a month hence "to discuss means of getting Mexican leaders of all factions to join in an effort to stop revolutions and restore order in Mexico." Representatives of a number of the warring factions are willing to concede an armistice and it is hoped that the Carranza faction, now in control of the Government, will join in this non-partisan movement. We hope most sincerely that it may achieve its alleged purpose and that the Mexican leaders, good and bad, will summon sufficient patriotism to set aside both rancor and greed to the end that their unhappy country may put itself in order before its neighbor, in self-defence, is compelled to intervene. The Administration at Washington represents the best public opinion in the United States in its unwillingness to interfere with Mexico's domestic affairs; even those owning mining property in Mexico and anxious to resume their productive activities are willing to give the Mexicans every chance to settle their own troubles; but it is as certain as anything can be that if the Mexicans continue to fight and rob each other promiscuously, with haphazard scattering of bullets among our peaceful people near the border and with an occasional raid across the line, there will come a time when patience will cease to be a virtue, if that time has not come already. Even the most liberal man, unwilling to consent to the exercise of force against a neighboring country distracted by interminable revolution, will find just reason for ending the reign of anarchy and bloodshed. Elsewhere in this issue we publish a letter from an American mining engineer, Mr. Blamey Stevens, who knows Mexico well and likes both the country and its people. He is of the opinion that international European interference is inevitable unless American intervention anticipates such an event. He emphasizes the fact, continually overlooked, that 80% of the Mexicans are Indians, unfitted by lack of education to give effect to the ideas of representative government. Before they can be educated, they must be able to live in peace. To let them lead a cat and dog life to the end of the chapter is no kindness. As the Monroe doctrine precludes European interference, it renders us responsible for the good behavior, internationally, of our southern neighbor. The Mexican problem must be faced manfully; "watchful waiting" has failed.

The Mexican Problem

The Editor:

Sir—Very often the clear statement of a problem is the equivalent of its solution. The clear statement of the Mexican problem has been difficult to obtain because there are so few people who know the conditions and who are at the same time disinterested enough to draw a perspective view of it.

Ever since 1910, when the present revolution began, Americans interested financially in Mexico have advocated the intervention of the United States. Within the United States, however, a certain element has been opposed to such intervention. President Wilson, by reason of his position of responsibility, has been about the only one who has been forced to try to define the sentiment that this element has felt. He says, "Mexico must no doubt struggle through long processes of blood and terror before she finds herself and returns to the paths of peace and order; but other nations, older in political experience than she, have staggered and struggled through these dark ways for years together to find themselves at last, to come out into the light, to know the price of liberty, to realize the compulsion of peace and the orderly processes of law."*

In other words, the President as a historian is led to believe that the best solution of the problem is the historical one of "blood and terror". Such a thought can hardly be held without repugnance by entirely disinterested Americans. These may remember that their own country for the most part has been built up on modern and not on historical lines. The old way to stop an epidemic was to let it run its course, the new way is by hygiene and sanitation. These people may ask themselves if there is no such modern way to treat revolutionary epidemics; revolutions having no ideals or even continuity of policy. They may well imagine that there may be some way corresponding to the raising of a child, by restraint and by education; the same way in which each generation of Americans learns good citizenship.

The Mexicans, as a people, have no clear perception of their own destiny, but they are agreed that they wish to preserve their nationality in its entirety. As a consequence they are extremely suspicious of the intentions of the American people. They think always of the alienation of the immense rich territory that now constitutes the States ranging from Texas to California. They think of the Panama Canal Zone and they are haunted with the nightly coyote—the call of the American jingoes—"Rio Grande to Panama"—and by these thoughts and threats of mailed fist policies are generated rancor and hatred.

It is, therefore, hardly possible that the Mexicans should welcome the suggestion of American intervention. As to President Wilson's plan, they are equally suspicious; for they see that, whether or no the policy is intended as such, it is simply a way of allowing Mexico to become weaker and more involved, so that when the Administration of the United States falls into aggressive hands Mexico will be partly or wholly absorbed. Moreover, the Mexicans realize that as time passes the western United States will become more and more crowded and that this will be the strongest argument for further American territorial expansion, especially as the northern part of Mexico would become largely inhabited by Americans and their descendants, who would desire the country to be taken into the American Union.

What would probably appeal to most Mexicans as the best solution of the problem affecting their country would be an international European intervention, instead of an American one. The more authoritative character of such an invasion of their sovereignty would take from it most, or all, of the stigma. Mexicans see that, as between such nations, there would be jealousy regarding territorial concessions or authority in Mexico, and that this would have the effect of preserving the sovereignty of their country. Many of the individuals taking part in such intervention would finally make their home in Mexico, assimilating with its population. All thinking Mexicans are in favor of European migration to their country, believing this to be its only solution, but with a revolution, or while revolution is possible, any general immigration cannot be expected.

European intervention is prohibited by that policy of the United States known as the Monroe doctrine. It is hard to conceive precisely what thought the statesmen of the United States have regarding the ultimate policy of their country, and it would be idle of them to publicly express such thought, but it is to be presumed that they foresee that the pressure of population of their country will ultimately cause the expansion of its people and industries over greater areas than they at present occupy. The Mexican and other Latin-American nations can only suppose that for this reason the Monroe doctrine does not in any way limit the actions of the United States and their people on the American continent.

*"The Mexican Question", by Woodrow Wilson. 'Ladies Home Journal', October 1916.

In spite of this negative factor in the Monroe doctrine, which makes the other American republics so suspicious of it, the United States government has generally been considerate of the rights of other peoples, and I believe that on similar lines it might, without in any way modifying the terms of the so-called Monroe doctrine, give Mexico the temporary advantage that she would receive from a joint intervention of European powers.

The working out of this general objective might be accomplished in a number of ways and the following is merely given as an illustration:

(1) The consideration of the problem by the League of Nations, hearing all the evidence and recommendations of Mexicans, Americans, and others called.

(2) The issue of orders by the League of Nations, to the United States, to intervene in Mexico for a stated limited purpose, advising Mexico of this order.

(3) Formal advice of the American government to Mexico, with invitations to co-operate and assist or make suggestions as to methods to be employed.

(4) The enlistment of Mexican and European troops by the American government from those nationalities most desired by Mexico.

(5) The enlistment of a minimum number of Americans to serve as officers. These to be acquainted with the Mexican language and customs.

(6) The establishment of a Mexican government composed of Mexicans accepting the authority of the League of Nations, and the support of such government by the army enlisted, putting down all revolutionary and bandit elements.

(7) The setting on foot by the Mexican government of colonization plans for the personnel of the army enlisted, retaining them as a national militia, and as a local police against bandits.

Since Europeans belonging to countries of much more power and prestige than Mexico have invited foreign intervention into the affairs of their country, it is hardly to be imagined that thinking Mexicans would not give their consent to the above plan if it were favored by the League of Nations.

One of the principal troubles in the past has been the narrow provincial ideas prevailing in the United States and an entire lack of acknowledgment of the proper virtues of the Mexican people or of recognition of the weaknesses of the American. For example, the Mexican people may much more quickly attain to the mechanical, sanitary, and hygienic perfections now possessed by the United States than the inhabitants of the latter country can attain the more basic fundamentals of good manners and taste, or the musical and artistic appreciation that the Mexican people almost universally possess. Nor may it be impossible that the Mexican people will ultimately arrive at that highest and rarest attainment of civilization, an efficient government.

For these purposes, however, Mexico needs European immigration, not to transplant the present race, but to introduce those faculties of initiative and enterprise which the indigenous element lacks. Fully 80% of the Mexican people are Indians who formerly belonged to semi-agricultural tribes; people of characteristics distinct from those of the United States Indians. When educated the Mexican Indians are philosophical and stable in character, contrasting sharply with the temperamental Latins, who form the minority element. The Indians are not necessarily inferior to the Latins, as the latter recognize, there being no remnant of race prejudice.

That the Indians are capable of high standards of civilization under a monarchy is well proved by their history. When the United States established a republic on the American continent, discontent with the old system was initiated in Mexico, and the people, ignorantly undertaking a similar change, have ever since been in an unstable condition of self-control.

Although, in its effect, this condition is base and sickening, its cause is an innocent one. It is due to the ignorance of the mass of the people; the same reason might be given for the Russian, or any other wholly internal chronic revolution. One often hears the half-blood element blamed, but it can hardly be doubted that if the same ignorant 80% of the population existed in the United States the obvious opportunity for over-ambitious spirits among the other 20% would assert itself to an even greater extent than in Mexico.

The whole revolution therefore resolves itself, like most other evils, into a condition for which no particular person or class can be blamed, and such a condition should cause no hatred or prejudice on the part of other nations. Furthermore, it is a fact that only a very small percentage of the people is engaged in revolt and banditry.

While there is a good excuse, however, it is not to be presumed that a corrective must not be sought. I mean rather to imply that the corrective must be based on fair and rational grounds, and not forced with wrath and violence. If, as I have stated, the cause of the trouble is the ignorance of the great mass of the people, it is evident that the cure is not to let these people continue to destroy themselves "with blood and terror", but to take steps to get them educated. And the first step in this direction is to end the revolution. After that a system of education must be planned along the lines suited to the best ideals and customs of Mexican national life, not the ready-made system of the United States or of any other country.

BLAMEY STEVENS.

El Paso, August 1.

IN connection with the British government's oil-developing scheme, drilling has continued uninterruptedly for a number of months, and oil has been struck at Hardstoft, Derbyshire, one of the areas being tested by Messrs. Pearson for the Ministry of Munitions. The oil is of light gravity and of good quality. The oil-bearing rock has been penetrated only a few inches. Although it is impossible at present to form any definite conclusion as to whether oil exists in paying quantities, the men in charge express themselves as satisfied with the prospects.

FIG. 1. THE DUMPS OF THE SWEENY MILL AT KELLOGG, IDAHO

Treatment of Tailing and Ore in the Sweeny Mill

By R. S. HANDY

The Sweeny mill near Kellogg, Idaho, formerly belonged to the Federal Mining & Smelting Co. and was used by it to treat ore from the Last Chance mine at Wardner. Following the operation of this mill there remains a dump containing about 1,200,000 tons of tailing assaying 1.89% lead and 0.73 oz. silver per ton, representing 22,194 tons of lead and 865,000 oz. of silver. The deposit is nearly 70 ft. deep at the apex and covers about 20 acres of river-bottom.

During the period of 18 years in which the mill was in operation four successive layers of tailing were deposited, as shown in Fig. 1. Dump No. 1 was the earliest and smallest deposit, and the succeeding layers increased in size but decreased in lead and silver contents.

When, in July 1918, the properties of the Federal company at Wardner and Kellogg reverted to the Bunker Hill company on account of the exhaustion of the Last Chance orebodies, the commercial possibility of using the Sweeny mill for re-treating tailing from this dump was investigated. The only other material available for the mill was small lots of ore from leases in the old Last Chance workings.

The tonnage in the dump was estimated by running lines at intervals of 250 ft. at right angles to the railway-track along the foot of the dump and making cross-sections on vertical planes following these lines, as shown in Fig. 2. From intersections of the surface planes of the several layers with these vertical planes, the cubic content and tonnage of each layer of tailing was calculated. The material weighs 110 lb. per cubic foot.

Owing to the depth of the deposit and the nature of the material composing it, an average sample of the whole dump could not be taken, but it was possible to get good samples of the various layers where they were exposed and could be identified. The sampling was done in this way, principally in open-cuts, but in a few favorable places shallow shafts were sunk for sampling purposes, as shown in Fig. 2. The average assay of the whole dump was derived from the tonnage-assay of the several layers. Decrease of richness as milling methods improved is clearly shown by the sampling, the first dump assaying 2.35% lead and 1.00 oz. silver per ton, whereas the last layer assays but 1.50% lead and 0.5 oz. silver per ton.

Laboratory tests were made on a composite sample representing the whole dump. The material was screened and sorted by hand into the products shown in Table 1. No attempt was made to sort the material below 20-mesh, the assumption being, from former experience, that about 60% of the lead and silver in this material could be saved on tables and by flotation. The tests indicated that 85% of the total material was of a size suitable for jigging, containing 81% of the total lead and 72% of the total silver. About 76% of the lead and silver contained in this portion of the sample was extracted in a product called 'jig-middling', assaying 4.28% lead and 1.5 oz.

silver per ton, leaving 70% of the weight in the form of 'tailing' assaying 0.56% lead and 0.2 oz. silver per ton. The jig-middling carried 20% excess of iron over insoluble, making it a product desired by the smelters for use as flux. At the high metal-prices then prevailing this was a satisfactory shipping product. Tests on the same general sample with a jig in the laboratory confirmed the hand-sorting tests.

It was assumed that the mill would treat 500 tons of tailing per 24 hours and that the milling costs would be as follows:

	Cost: Per day, $	Cost: Per ton, cents
Labor:		
1 foreman at $7 per day	7.00	
6 mill men at $5.25 per day	31.50	
1 watchman at $4.75 per day	4.75	
2 excavators at $5.50 per day	11.00	
	54.25	10.8
Power and supplies:		
80% of labor cost	43.40	8.7
Overhead expense	27.50	5.5
Total	125.15	25.0

From 1200 tons of feed, assaying 1.73% lead and 0.75 oz. silver per ton, containing 20.76 tons of lead and 900 oz. silver, 83 tons of shipping product was made, assaying 12.3% lead and 4.24 oz. silver, containing 10.27 tons of lead and 352 oz. of silver. This corresponds to the extraction of 49.4% of the lead and 35.5% of the silver. The net smelter-value of this shipping product was $1486, or $1.24 per ton of feed. With lead at 4.5c. per pound, and silver at 60c. per oz., the value would have been 55c. per ton of feed. The mill treated 600 tons per 24 hours.

Upon this showing, re-modeling the mill for tailing treatment was authorized and the flow-sheet shown in Fig. 4 was designed. The principal change was the removal of the fine jigs from the main building, thereby providing space for tables and flotation machines and eliminating the slime-house. This made the plant compact, and dispensed with one operative per shift. Screens of 20-mesh were included in the trommel system and adequate classifying equipment was provided. Plans were made to place a conveyor along the roof of the mill on the line shown in Fig. 1 in order to transport tailing from the dump to the feed-storage bins, using a mechanical excavator to supply tailing to the conveyor. There was

ORIGINAL

Bunker Hill and Sullivan M. & C. Co.

SWEENY MILL

ORE SETTLEMENT FOR April 1919 DATE...

LEASE No 2 LEASER ADDRESS...

SETTLEMENT NO.	ORE MILLED: WET TONS	MOISTURE	DRY TONS	ASSAY: % Pb	ASSAY: OZ. Ag.	CONTENTS: TONS LEAD	CONTENTS: OZ. SILVER	AVERAGE ASSAY OF ALL LEASERS' CONCENTRATES PRODUCED: Pb	AVERAGE ASSAY OF ALL LEASERS' CONCENTRATES PRODUCED: OZ. Ag	EXTRACTION: % LEAD	EXTRACTION: % SILVER	PER CENT OF TOTAL METAL RECOVERED: LEAD	PER CENT OF TOTAL METAL RECOVERED: SILVER	NET SMELTER VALUE OF ALL LEASERS' CONCENTRATE
22	23195	20	227.30	9 15	3 2	20.797	727.36	45 0	15 0	79 0	81 0	42.65	43.66	2702 04

CALCULATIONS AND SETTLEMENTS

	FACTOR A	FACTOR A (All Leasers)	PER CENT A divided by B			
42 65 % Lead recovered X $ 2702.04 value	115242					
43 66 % Silver recovered X $ 2702.04 value	117971					
	233213	433485	53.80			
53 80 % of $ 2702 04 total value—NET SMELTER RETURN						1454 25
Less Portion of milling cost 23 hours @ 7.41 per hour				170 47		
Less Rental of mill 227 30 tons @ 15 ¢ per ton				34 09		
Less Royalty 15 % of $ 1454.25				218 15		
Less Warehouse Account as per invoice herewith						
Less Freight on ore from Arizona Tunnel to Sweeny Mill				45 46		
						468 17
NET PROCEEDS						986 08

Checked ..... Cashier

FIG. 6. SAMPLE OF SETTLEMENT WITH A LESSEE

The net smelter-value of the mill-product at the prevailing prices was estimated at $1.10 per ton of mill-feed, leaving a profit of 85c. per ton.

It happened that at this time the railway company was excavating tailing for ballast from the western edge of the dump, and, as the mill is served by a branch of the railway, about 1200 tons was diverted to the mill-bins and subjected to a working test. In this test the mill was arranged as it had been used by the Federal company, as shown in Fig. 3, except that the fine jigs were cut out

an idle steam-shovel at the plant, however, and the arrangement of the railway tracks suggested this as a temporary means of feeding the mill. The shovel was placed in the pit abandoned by the railway company and arrangements were made for transporting the tailing to the mill at a fixed price per car-load. Mechanical troubles with the shovel and transportation difficulties made this method expensive and unsatisfactory, therefore the conveyor as originally planned is now being built.

The re-modeled mill was started in December 1918 and has been operated since on a basis of two 8-hour shifts per day. No real difficulties have been encountered other than those due to excavating and transporting the mill-feed, but these have naturally affected the mill effi-

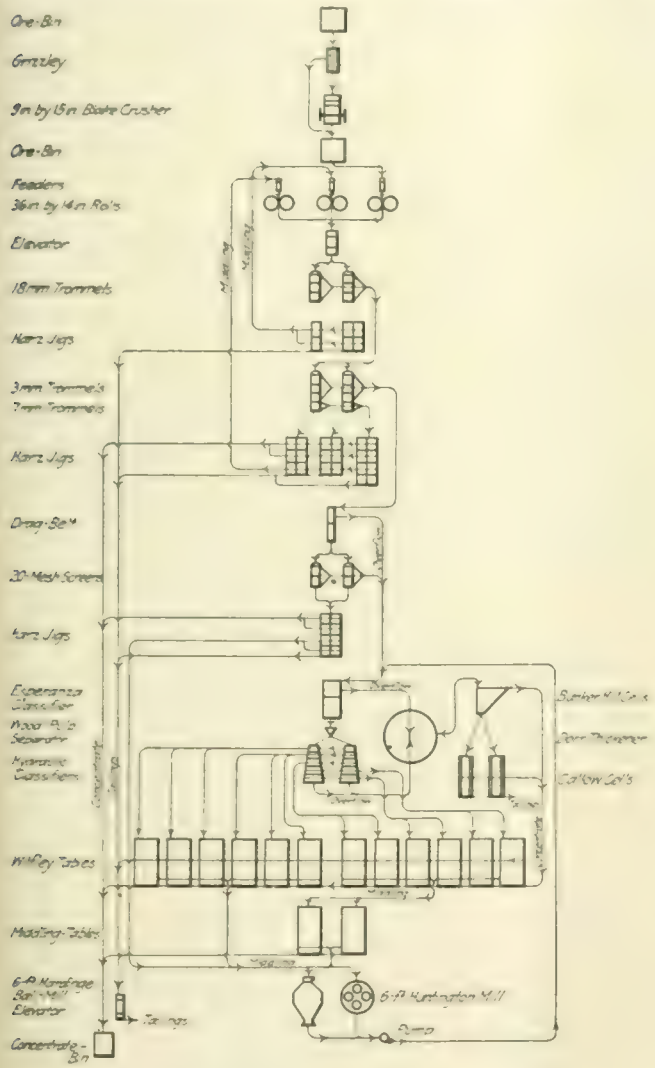


FIG. 4. FLOW-SHEET OF SWEENY MILL

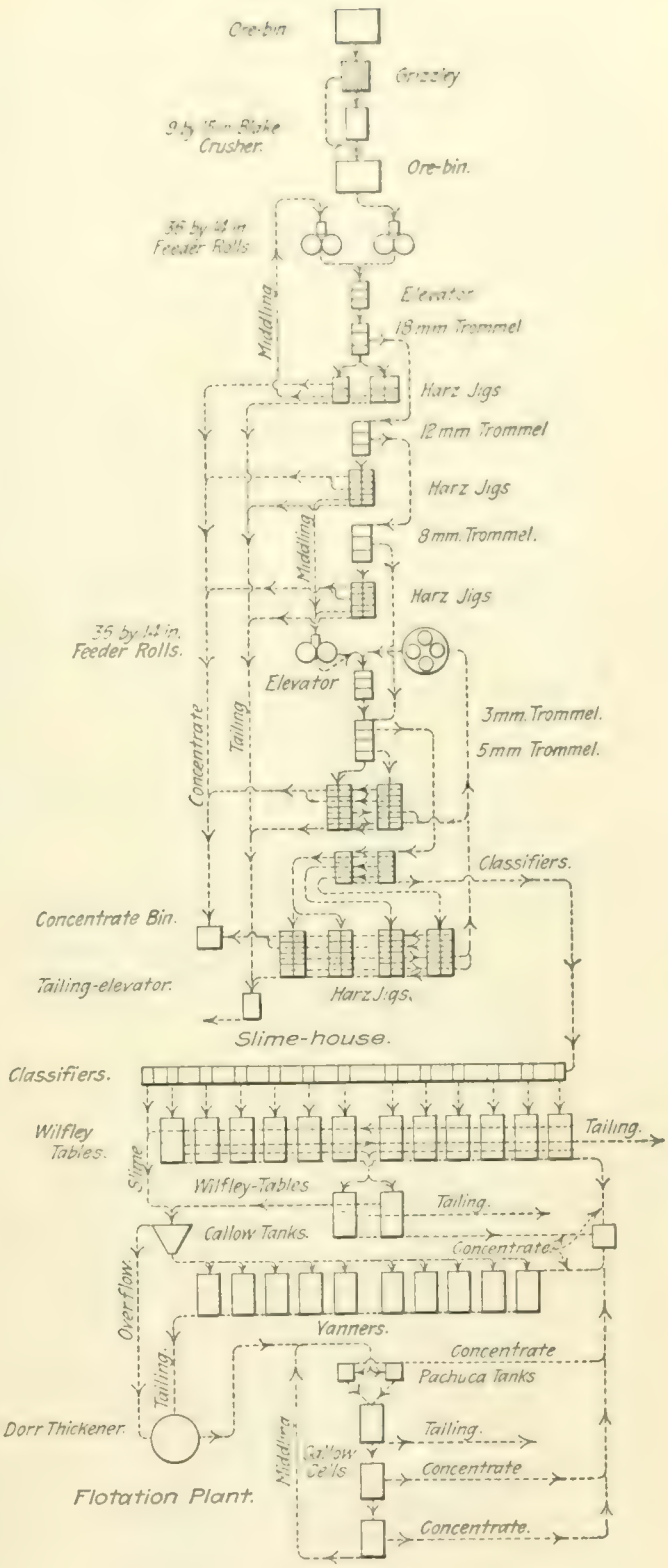


FIG. 3

Milling Costs in Cents Per Ton

	Excavating and transportation	Crushing and conveying	Screening	Jigging	Grinding	Concentrating	General	Total
Labor	3.65	0.38	...	4.75	1.29	3.43	2.12	15.62
Supplies	3.65	1.47	0.68	0.97	1.54	0.70	1.54	10.55
Train service	18.89	1.95	...	...	...	...	...	20.84
Power	....	...	...	0.38	2.40	1.57	..	4.37
Taxes, insurance, and depreciation	...	...	...	...	...	..	8.30	8.30
Maintenance and repairs	1.90	..	...	...	...	...	..	1.90
Miscellaneous	....	...	...	...	...	...	3.01	3.01
Total	28.09	3.80	0.68	6.10	5.23	5.70	14.97	64.59

Fig. 5. TABLE SHOWING METHOD OF CALCULATING FOR SEPARATE LEASES

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
	Feed — Assay					Concentrates — Assay										
	Wet Tons	Lead %	Silver Oz	Lead Tons	Silver Oz	Tons	Lead %	Silver Oz	Lead Tons	Silver Oz	Tons	Lead %	Silver Oz	Lead Tons	Silver Oz	Lead %	Silver %
							Lease No. 1										
Total	47.55	16.30	1.00	6 690	185 70	13.95	46 88	12 60	5 602	150 56	34 35	3 16	1 01	1 085	34 74	81 10	81 00
Flotation	9.00	11.90	6.00	1 341	54 00	2.05	45 70	17 30	0 938	39 96	6 56	5 80	1 00	0 403	14 04	30 00	74 00
Jigs and tables	38.30	14.34	3.51	5 349	134 70	9.90	47 10	14 20	4 664	110 60	27 80	2 30	0 70	0 682	20 70	14 30	18 30
							Lease No. 2										
Total	221 90	9 15	3 30	20 296	7 32 36	89 61	11 78	14 88	16 513	589 40	187 99	2 36	0 73	4 004	135 96	79 00	81 00
Flotation	13 00	11 00	4 00	2 737	92 00	4 15	50 80	17 40	2 110	71 54	18 85	3 80	1 08	0 788	26 46	37 10	77 10
Jigs and tables	208 90	8 84	3 11	18 060	649 36	85 46	40 70	12 60	14 133	517 86	169 84	2 19	0 70	3 095	111 15	24 51	24 51
							Lease No. 3										
Total	37 80	9 15	3 40	3 385	125 80	5 51	53 63	18 11	2 956	99 79	31 49	1 35	0 80	0 501	17 01	29 90	28 00
Flotation	1 00	9 00	6 00	0 360	24 00	0 56	45 80	33 60	0 256	18 86	3 41	3 05	1 90	0 104	3 14	11 00	13 00
Jigs and tables	33 00	9 17	3 10	3 025	101 80	4 95	51 50	21 00	2 701	80 93	28 05	1 11	0 74	0 398	13 87	13 90	24 90
							Lease No. 4										
Total	50 75	7 99	3 80	3 696	180 05	6 00	50 70	26 52	3 040	159 15	43 75	1 31	0 50	0 786	26 80	34 90	26 10
Flotation	1 00	10 45	6 60	0 148	26 40	0 55	50 30	34 80	0 278	20 09	3 46	4 05	1 80	0 110	6 30	26 30	25 30
Jigs and tables	45 75	7 91	3 55	3 598	162 65	5 45	50 70	27 40	2 762	139 06	40 30	1 10	0 64	0 446	20 50	8 30	8 30
							Lease No. 5										
Total	139 55	2 80	0 80	4 384	122 40	7 01	37 50	10 60	2 957	83 86	145 99	0 91	0 36	1 325	52 54	68 30	68 30
Flotation	24 00	2 80	1 80	1 824	67 90	2 55	50 90	22 40	1 300	47 98	91 45	2 45	0 89	0 635	24 70	23 40	23 40
Jigs and tables	129 00	1 91	0 43	2 460	55 50	5 36	30 90	11 30	1 658	35 88	123 61	0 65	0 15	0 805	19 84	6 60	6 60
							Summary										
Total	537 40	7 55	2 92	38 782	1349 81	70 98	43 80	15 20	31 098	1082 78	442 37	1 73	0 66	7 684	267 54	50 15	50 30
Flotation	64 00	10 43	4 12	6 680	263 60	9 86	49 04	20 12	4 830	198 45	54 14	3 82	1 50	1 844	63 04	37 40	37 40
Jigs and tables	449 35	7 14	2 41	32 102	1086 21	61 12	43 00	14 50	26 268	884 33	388 23	1 54	0 53	6 840	204 50		

ciency unfavorably. It is expected that the conveyor will solve most of these difficulties.

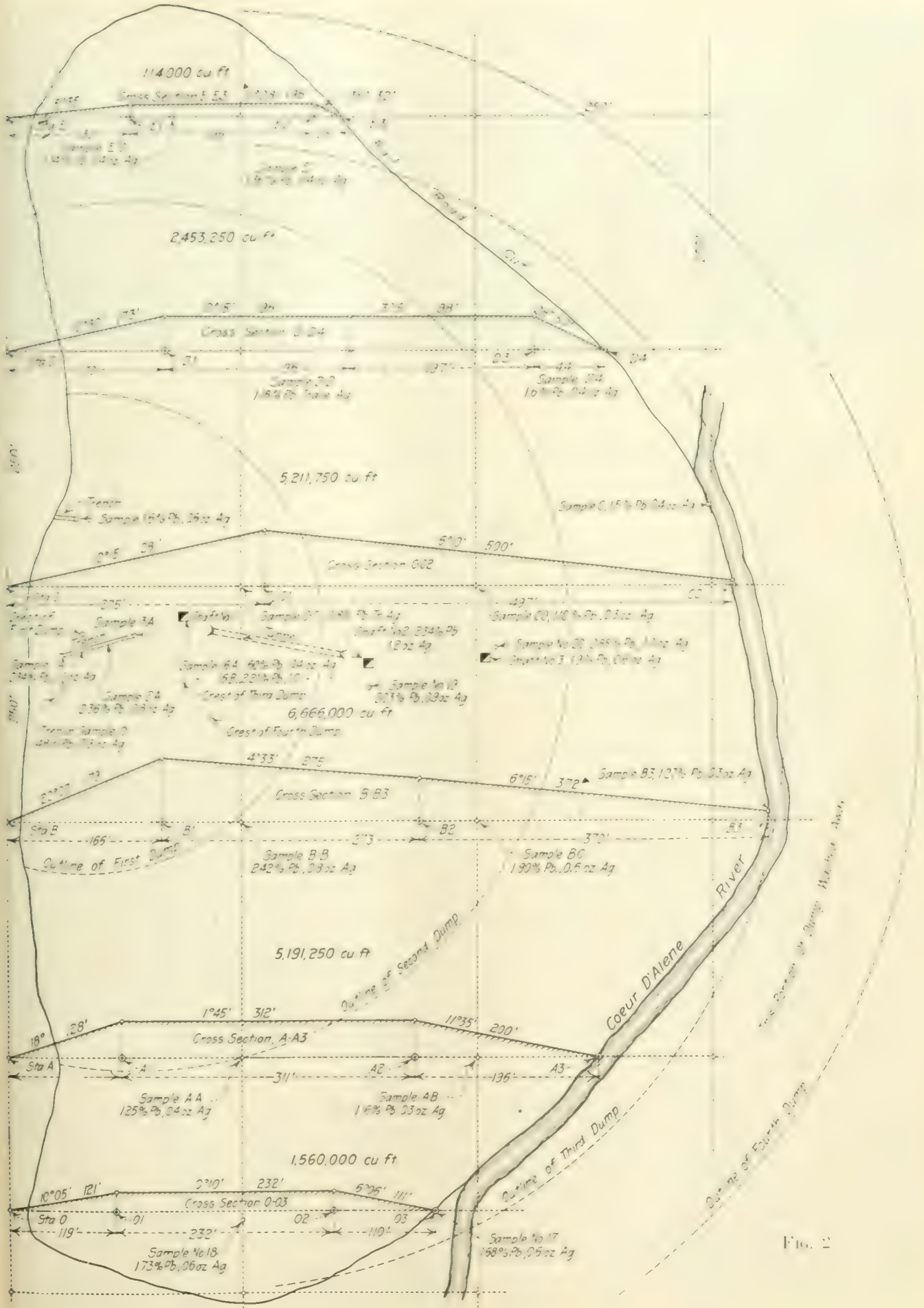
The grade of the product and the lead extraction have been practically the same as in the test, but the silver extraction is now slightly higher than that of the lead. Operating costs are shown below in cents per ton of mill-feed, based on 166 tons per 8-hour shift.

When running at full capacity for 24 hours per day, with the cost of excavating and conveying the tailing reduced to a few cents per ton by the use of a conveyor, the estimated cost of 25c. per ton will be achieved.

Ore from the leases in the old Last Chance mine-workings comes to the mill in small lots aggregating from 50 to 400 tons per month per lease. The mill is now receiving ore from eight leases, and as storage consists of four bins of 150 tons each, frequent runs must be made on this ore in order to provide separate storage for each lease.

The Bunker Hill company does not buy the ore, it acts only as a milling agent, and after deducting royalty and milling charges, turns the proceeds of milling over to the lessees. The equitable distribution of these proceeds presents an interesting problem. It would naturally be supposed that bins could be provided for storing the concentrate belonging to each lease, so that the concentrate may be shipped and settled for accordingly. This method is impracticable because the flotation concentrate cannot be successfully settled with jig concentrates on account of the large volume of water required to carry them. Also, the large circulating load in the Dorr thickeners feeding the flotation plant precludes any sharp division in the pulp from lots fed to the main mill. Furthermore, the jig-beds, sumps, and launders contain a large quantity of lead in material that is constantly shifting, so that it could not be identified as belonging to any particular lot. The only solution of the matter was to combine the concentrates from the treatment of all of the lease ore and to depend upon automatic samples of feed, concentrate, and tailing of each lot of lease ore to determine the distribution of the final proceeds. This method involves considerable mathematics, but has solved the problem satisfactorily. The application of this method to actual conditions is given below.

Each lot of lease ore is weighed and is sampled automatically as it passes through the mill. The tonnage of feed to the flotation plant, being uniform, is determined by time samples, and all the flotation products are sampled in addition to the jig and table products on account of the separate disposal of the concentrates from the two systems. The well-known formula $\frac{(F-T)}{E(C-T)}$, where C is the assay of the concentrate, F the assay of the feed, and T the assay of the tailing, is used for establishing the extraction of the metals. The metal contents of the feed and the extraction being known, the weight and contents of the other products may be calculated as shown in Fig. 5, where the formula for finding the results in each column is given at the head of the column. These data are summarized and the percentage of the total lead and


114,000 cu ft
2,453,250 cu ft
5,211,750 cu ft
6,666,000 cu ft
5,191,250 cu ft
1,560,000 cu ft
Cross Section 0-04
Cross Section 0-02
Cross Section B-B3
Cross Section A-A3
Cross Section 0-03
Sample 3A
Sample 04
Sample 02
Sample 03
Sample 0-3
Sample 0-4
Sample 0-2
Sample 0-1

of the total silver extracted for each lease is determined. Each of these percentages is multiplied by the net smelter-value of all of the lease concentrates, giving a lead factor and a silver factor, which are added together and called factor A. The sum of all factors A gives factor B, from which, related to the factors A, the percentage of the total net smelter-value for each lease may be determined. This is all clearly shown on a copy of a settlement sheet, in Fig. 6.

It is gratifying to find that the smelter returns check closely with the calculated contents of the lease concentrates. In April the proceeds of milling the lease ore as calculated by use of the formula above was 70.98 tons of concentrate assaying 43.8% lead and 15.2 oz. silver per ton, containing 31,098 tons of lead and 1082.78 oz. of silver. The actual smelter returns gave 72.18 tons of concentrates assaying 45% lead and 15.0 oz. silver per ton, containing 32,481 tons of lead and 1082.70 oz. of silver.

TABLE I

Screening and Hand-Sorting Test of Average Sample of Sweeny Mill-Dump, September 2, 1918

Screen size, mm.	Total weight, %	Assay—Lead, %	Assay—Silver, oz.	Total—Lead, %	Total—Silver, %
Jig Middlings					
On 18.85	1.72	3.59	1.00	3.50	2.44
13.33	3.62	4.43	1.20	9.09	6.16
9.42	5.25	5.25	1.20	15.60	8.93
6.68	4.64	3.65	1.80	9.60	11.84
4.70	3.74	5.80	2.00	12.30	10.61
3.32	2.13	3.17	1.40	3.83	4.23
2.36	1.15	4.42	1.40	2.89	2.28
1.65	0.83	3.15	1.60	1.48	1.88
1.17	1.30	2.54	1.20	1.87	2.21
0.83	1.15	2.70	2.40	1.76	3.91
Total	25.53	4.28	1.50	61.92	54.44
Jig Tailings					
On 18.85	5.19	0.00	0.00		
13.33	7.60	0.25	0.10	1.08	1.07
9.42	9.65	0.10	0.10	2.19	1.36
6.68	9.04	0.57	0.20	2.92	2.56
4.70	7.13	0.55	0.20	2.22	2.02
3.32	6.58	1.02	0.40	3.84	3.73
2.36	5.06	1.00	0.40	2.87	2.87
1.65	4.36	0.85	0.40	2.10	2.47
1.17	2.69	0.68	0.20	1.04	0.76
0.83	2.31	0.70	0.20	0.91	0.65
Total	59.61	0.56	0.20	19.17	17.49
Table and Flotation Material					
Mesh					
On 28	4.61	1.60	0.80	4.18	5.23
35	3.31	1.58	0.80	2.96	3.75
48	3.60	3.60	1.20	5.30	4.42
65	1.45	1.78	1.00	1.46	2.05
100	1.00	2.20	1.20	1.24	1.70
150	0.30	2.40	1.60	0.40	0.64
200	0.36	3.28	2.20	0.67	1.12
Through	1.17	3.84	5.40	2.55	8.96
Total	14.80	2.23	1.32	18.76	27.87
Grand total	99.94	1.56	0.70	99.85	99.85

Manganese Production Decreasing

Reports sent by operators of manganese mines to the U. S. Geological Survey, covering the first three months of 1919, show that the shipments of manganese ore during that quarter were much smaller than during any other quarter since 1917. The shipments of high-grade ore were 23,937 tons, against 75,465 tons during the last quarter of 1918 and 305,869 tons during the entire year. The number of shippers was only 24, against 247 during the year 1918. The shipments of low-grade ore, containing 10 to 35% manganese, were 35,516 tons, against 320,455 tons during the last quarter of 1918 and 916,163 tons during the year. The extraordinary decrease in shipments is due to the unwillingness of the makers of ferro-manganese to increase further their rather large stocks of ore, which were purchased at high prices, especially as there is now only a small market for the alloy. Early in November 1918 the stocks of high-grade ore and ferro-manganese were equivalent to nearly nine months supply; the price of 50% ore ranged from $60 to $67 per ton, and the price of 80% ferro-manganese was $290 per ton. In June 1919 the prices offered for 50% ore by the few furnaces that were making purchases ranged from $25 to $35 per ton and the price of 80% ferro-manganese ranged from $110 to $125 per ton. The market for ferro-manganese since January has been controlled by the surplus supply of the alloy, which is largely in the hands of steel makers, who prefer to sell their stocks and bear the loss rather than hold them longer. Practically all the ore shipped during the first quarter was material delivered on contracts made before November 11, 1918. The willingness of several large consumers of ore to continue to accept material offered under old contracts has permitted a few fortunate operators to carry on their work, but the repudiation of contracts by several companies has been a source of hardship and great loss to many operators in the United States, as well as to some in Cuba and Porto Rico. The outlook of the domestic ore industry is gloomy, and there is no reason to change an earlier estimate that the shipments for the year will probably not exceed 60,000 tons. A bill recently introduced in Congress provides for a tariff on manganese ore of 35c. per unit of manganese, or $17.50 per ton for 50% ore, and a tariff on ferro-manganese and spiegeleisen of 75c. per unit of manganese, or $60 per ton for 80% ferro-manganese.

TABLE II

Products From Mill-Test, October 12-23, 1918

Date	Jig Tailings 50 to 18 mm. lead	18 to 13 mm. lead	13 to 8 mm. lead	8 to 3 mm. lead	3 mm. to 20-mesh lead.	Jig middling lead	Jig middling silver	Table concentrate lead	Table concentrate silver
	%	%	%	%	%	%	oz.	%	oz.
Oct. 12	0.48	0.34	0.64	0.72	0.50	8.0	3.0	21.5	7.8
13	0.60	0.84	0.44	0.80	0.60	6.0	2.2	30.0	9.4
14	0.40	0.68	0.60	0.30		6.2	2.6	14.0	5.2
15	0.90	0.84	0.80	0.58	0.46	17.0	4.4	32.4	10.2
16	0.60	0.48	0.70	0.78	1.00	12.6	4.4	9.9	3.4
17	1.10	0.82	0.70	0.68	1.30	12.6	4.2	28.5	9.4
18	0.70	0.60	0.70	0.88	0.90	13.2	4.2	25.7	9.4
19	0.70		0.80	0.92	1.00	9.8	3.2	20.0	6.8
20	0.24	0.70	0.70	0.84	0.78	10.2	4.0	25.0	7.8
21	0.48	0.50	0.50	0.74	0.90	8.2	3.4	24.0	7.4
22	0.90	0.40	0.70	0.74	1.00	7.7	3.0	23.5	7.8
23	0.50	0.50	0.48	0.50	0.78	11.0	4.2	27.2	9.2
Average	0.68	0.60	0.65	0.72	0.84	10.0	3.5	23.4	7.8

FINCH QUARRY OF THE NORTHWEST MAGNESITE CO., NEAR CHEWELAH, WASHINGTON

The Magnesite Industry in the United States

By W. C. PHALEN

INTRODUCTION. *Magnesite is one of the non-metallic minerals. The importance of many of the non-metallic minerals is usually lost sight of, not only among the general public, but among the mining fraternity as well, for the reason that little glamor surrounds such substances as magnesite, mica, or asbestos, the rôle of which perhaps may be considered a humble one in the industrial world, even though a necessary one. It is a fact, however, that non-metallic minerals and products, in general, touch our daily life very closely and on a scale the index of which is furnished by the following figures:

The total value of the non-metallic minerals and products made from them in 1917 exceeded the value of metallic minerals or products by $797,098,445. In 1916 this excess in value amounted to $257,955,497. Of all the mineral commodities produced in the United States in 1917, the first ten arranged in value of output were as follows: coal, pig-iron, petroleum, copper, clay-products, natural gas, cement, zinc, lead, and ferro-alloys. The list itself is the same as for 1916, except that in the latter year gold is included instead of ferro-alloys. The order for 1916 is slightly different and was as follows: coal, pig-iron, copper, petroleum, clay-products, zinc, natural gas, cement, gold, and lead. It will be observed, therefore, that five of the commodities were metallic and five belong in the non-metallic class for each year. The total value of metallic and non-metallic products is listed below.

Table Showing Value of Metallic and Non-Metallic Products†

	1916	1917
Non-metallic products	$1,878,163,681	$2,888,923,007
Metallic products	1,620,508,184	2,091,824,562
Excess in value of non-metallic products	$257,955,497	$797,098,445

†Figures from U. S. Geological Survey, Division of Mineral Resources.

DEVELOPMENT OF THE INDUSTRY. Magnesite may be considered a war mineral. It was a war mineral in the sense that prior to the War our supply to the extent of 96 to 97% was imported, chiefly from Austria. Our small domestic production of 3 to 4% came entirely from California. During 1917, after a fair recovery from the slump which the industry experienced in 1915 as a result of the cessation of imports and before domestic production had gained much headway, importations amounted to only 11% of the total quantity consumed, and of this 11% a portion, which was high in lime, came from Canada.

From a pre-war output of about 10,000 tons reckoned as 'crude', production in California increased to 211,000 tons in 1917, but fell back to 90,000 tons in 1918. Production in the State of Washington began in December 1916 with an output of 715 tons, increasing to 105,000 tons in 1917 and approximately 130,000 tons in 1918. Thus the history of the magnesite industry shows an almost complete reversal from a foreign to a domestic status during the brief space of five years.

ORE DEPOSITS. Magnesite is widely distributed in California, occurring in the Coast range and along the west slope of the Sierra Nevada. Deposits are known to extend from Mendocino county on the north to Riverside county on the south—a distance of 500 miles. The Coast range counties in which it is known to occur are Alameda, Mendocino, Napa, San Benito, Santa Clara, Sonoma, and Stanislaus; it is also found in Fresno, Kern, Placer, Riverside, Tulare, and Tuolumne—13 counties in

*Published with permission of the Director of the U. S. Bureau of Mines. The writer is Mineral Technologist to the Bureau.

all. The most important deposits are found in Tulare, Santa Clara, Napa, and San Benito counties.

The greater part of the magnesite in California occurs in the form of veins or lenses of variable length and thickness in massive serpentine. Some of the magnesite masses are as much as 30 ft. in thickness and from this thickness they range to mere stringers and gash veins too thin to work. The Californian magnesite is of the amorphous type.

In Washington, the mineral is crystalline and occurs as massive beds in a sedimentary series in which are found dolomite, shale, and quartzite into which basic igneous rocks have been intruded. The only known deposits are within a radius of 5 to 12 miles south-west of the town of Chewelah, in Stevens county, or about 60 miles north of Spokane.

Methods of Mining. In Washington regular quarrying methods are employed in getting out the ore. Tunnels are run into the hill at convenient points and raises are put up to the quarry-floor. The ore is allowed to fall through such raises into small cars that are trammed by hand to the surface. In California, where the veins are often thick and steeply dipping, various mining methods are employed, depending on the thickness and attitude of the veins. Glory-holes are dug where the masses are very thick, but overhand stoping with back-filling to prevent caving is the usual method.

The mines are usually some distance from the calcining-plants, so aerial trams are employed to carry the ore to them. An elaborate system of gravity plains and chutes is used at the mine of the Tulare Mining Co. near Porterville. In this method empty cars are hauled back by horses.

Methods of Calcining the Ore. Magnesite by weight consists of 47.6% magnesia and 52.4% carbon di-oxide. Calcination, therefore, saves freight. Soon after the War started, nearly every important mine in the West established a calcining-plant where at least a preliminary burning was carried out. As time went on, methods employed were perfected and our facilities for calcination, both in method and capacity of furnaces, are now comparable with those used in Austria before the War.

Calcination is effected in different types of kilns: (1) bottle-shaped kilns; (2) vertical kilns resembling lime-kilns; and (3) rotary kilns, like those used in the manufacture of cement. Distillate or crude oil is the fuel in chief use in California, but coke is employed at one plant. The distillate is sprayed with air or steam into the four different compartments of the bottle-shaped kilns and the waste-heated gases serve to heat the crude ore as it descends from the intake to the reverberatory chambers, where actual calcination takes place. Coke, where used, is mixed directly with the crude magnesite and its content of ash, therefore, has to be as low as possible. At most plants there is good economy of waste heat and action is practically continuous in all the different types of kilns.

At the up-to-date plant of the Northwest Magnesite Co. at Chewelah, Washington, five rotary kilns are installed and a sixth is on the ground ready to be set up. Powdered coke is the fuel used and the capacity is 60 to 65 tons of dead-burned magnesite per kiln per 24 hours, making a total of 325 tons per day or approximately 10,000 tons per month. When the sixth kiln is installed this will be increased to 12,000 tons per month. The American Mineral Production Co., operating near Chewelah, has shipped its material recently to the plant of the International Portland Cement Co. near Spokane, where it is dead-burned in 165-ft. rotary kilns. In general, it may be said that American practice is comparable with foreign practice so far as rotary kilns are concerned. Action in rotary kilns is continuous.

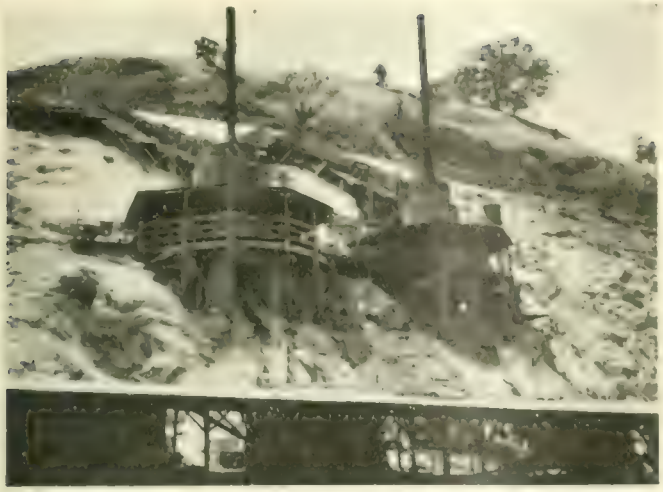
Capacity of kilns varies according to the different types. The usual practice in the bottle-shaped kilns gives 15 to 20 tons of calcine per 24 hours; in 125-ft. rotary kilns, 60 to 75 tons per 24 hours; and in the vertical kilns, 7 tons per 24 hours. In the bottle-shaped kilns only coarse lump magnesite can be calcined; the fine cannot be used for the reason that it obstructs the draft. In rotary kilns all sizes may be calcined, fine as well as lump.

Calcination yields two products. If the burning is carried to the point where 3 to 4% of carbon di-oxide is left, the product is referred to as 'caustic' and is consumed principally in the flooring trade. Greek magnesite was extensively used in flooring cement prior to the War and Californian magnesite is now being used in part for this purpose. If dead-burned, namely, to the point where it contains only ½% of carbon di-oxide by weight, it is referred to as dead-burned; and approximately 90% of the total consumption of the United States is of this kind.

The calcining capacity of the Californian plants is estimated at 10,000 tons per month. In Washington, considering one plant alone, there is a calcining capacity of 10,000 tons per month, making the present available capacity of the country in excess of 20,000 tons per month, or 240,000 tons per year, which is more than ample for our present requirements.

The reserves of magnesite in Washington are of much greater magnitude than those of California. If the annual consumption of raw magnesite in the United States be taken as 350,000 tons, our domestic supply will easily last at least a generation and there is always the possibility of the discovery of new deposits. No deposits are pure, and magnesite for the trade has to be selected with care, but in this respect domestic deposits are no different from the more important foreign sources.

The uses of magnesite are restricted. Its main use is as a refractory in lining open-hearth steel-furnaces; but a comparatively small quantity is consumed per ton of steel manufactured. The total world production has been estimated to be between 400,000 and 500,000 tons yearly. The United States is the main consumer, its consumption being estimated at three-fourths of the world output. The total value, at the mines, of the



CALCINING PLANT OF THE TULARE MINING CO.

VERTICAL KILNS OF THE AMERICAN MINERAL PRODUCTION CO.

crude material of domestic production did not exceed $3,000,000 in 1917, but on the calcined basis the value of the product was approximately $8,000,000.

Some magnesite is used for medicinal and chemical purposes. Californian magnesite has been used in making sulphite paper-pulp, but this use is now negligible, the magnesite having been replaced largely by dolomite for this purpose on the Pacific Coast. Magnesite has also been used as a source of carbon di-oxide gas, making use of the resultant caustic product; also in fire-resisting magnesia paints and as a non-conducting material for boiler and pipe coverings. A larger quantity is used in making flooring cement. The main use of magnesite is as a refractory for lining open-hearth steel furnaces and in lead, copper, and electric, or other heating, melting, and welding furnaces. It is estimated that 90% is consumed for use in these refractories.

The mineral is used in two forms: crude and calcined. Calcination results in two products, depending upon the intensity of the burning. One product is the 'dead-burned' magnesite used in grain form for furnace-linings or manufactured into magnesite brick, which is also used in lining furnaces. The other calcined product, known as caustic magnesite, has not been burned quite so much and contains 3 to 4% carbon di-oxide, whereas the dead-burned does not carry more than ½ of 1%. Caustic magnesite is mixed with various ingredients such as wood-flour, cork, asbestos, silica, talc, coloring matter, and magnesium chloride to form the Sorel cement of the plastic-flooring trade. It sets quickly and produces a floor that is dustless and resilient. Common report is to the effect that it was used by the Austrians and Germans on the Western front in making gun-emplacements on account of its quick setting properties and its resilience.

Crystalline magnesite has long been considered the best material available for furnace-bottoms. It came from Austria before the War, but during the War important supplies were developed in Washington. Austrian magnesite contains such a proportion of iron oxide as to make it 'bond' or set well on furnace-bottoms, thereby forming a hearth of great density, which is subject to minimum erosion by molten steel and which is hardly affected by slag. To the Washington mineral, iron oxide has to be added in small quantity to bring this constituent up to the required standard. The silica and lime in the Washington product are higher than in the foreign, but the specifications with respect to these constituents and to iron and alumina have been well met by American producers.

The amorphous variety has been used in furnace-bot-

CALCINING PLANT OF THE PORTERVILLE MAGNESITE CO.

NORTHWEST MAGNESITE CO., NEAR CHEWELAH

tons, but has been found not so satisfactory as the crystalline for refractory purposes, owing to its high degree of purity (absence of iron, more especially), which makes it so refractory that it will not bond or fuse and thus form the dense bottoms or hearths so desirable in making steel.

Some of the Californian product contains naturally a small percentage of iron oxide and this iron-bearing magnesite was used for refractory purposes during the War; but under normal conditions neither Californian nor Greek magnesite has been used for refractory purposes to any considerable extent. The amorphous variety, which is of a dead-white color, is particularly adapted to making flooring material and for the minor miscellaneous uses to which the pure product is applied.

Before the War, between 6 and 14 pounds of magnesite was used per ton of steel, according to estimates of certain Eastern steel-makers. The quantity used was cut approximately in half during the War, owing to the scarcity and high price. These conditions in turn led to the part substitution of dead-burned dolomite for dead-burned magnesite. The dolomite so used, was, as a rule, specially prepared to avoid the difficulties caused by the presence of free lime. About 3 to 7, or an average of 5, pounds of magnesite per ton of steel was consumed in 1917 and this may be considered approximately the present consumption. In other words, our magnesite consumption per unit of steel is about half of what it was during the pre-war period.

The cost of the magnesite consumed per ton of steel is small. Last spring with the price of magnesite brick weighing 10 lb. each at $450 per thousand and with grain magnesite at Chester, Pennsylvania, at about $48.50 per ton, the cost of magnesite per ton of steel on the basis of half brick and half grain would not be far from 17 to 18 cents. Economy in the use of magnesite, and particularly in the use of dead-burned grain and the substitution therefor of dead-burned dolomite, have tended to offset the high war prices. Dead-burned dolomite has been used in the past as a refractory in repairing furnace-linings, but statistics showing the extent of this application are lacking. According to the U. S. Geological Survey, 340,000 tons of dead-burned dolomite was marketed in 1917, which indicates at least an important degree of competition with dead-burned grain magnesite.

Total Investments. Most of the plants where calcining is done are large and in many places there have been considerable investments. It is estimated that the total investment in California and Washington is from $3,500,000 to $4,000,000. The number of men employed at present in California is estimated at approximately 150 to 200. On the assumption that this is about 25% of what it was during the War, the total number of men formerly employed in this industry was 800 or 1000. The total number of men employed during the War at the different properties in Washington was probably not far from 400 or 500. Thus, it is estimated that the industry would normally employ more than 1000 men, with 1500 as a maximum. These figures include only men engaged in the actual producing and transporting end of the business.

Minerals in Ireland

From investigations which have so far been carried out it has become evident that, though the general prosperity of the mineral industry of Ireland during the early part of the nineteenth century is hardly likely to be revived, a substantial increase in the production of certain minerals could be maintained under improved conditions. Since the outbreak of the War, not only has the normal production of minerals not been maintained, but there has been in almost every case a very considerable falling off in the output. The production of non-ferrous metals in recent years has been negligible. A good deal of prospecting has been done on the Avoca group of copper mines in County Wicklow, and it is now estimated that considerable quantities of low-grade copper ore have been proved. Exploration for secondary enrichment of these mines has taken place, and it is stated that there appears to be a fair prospect of their becoming important copper producers. Tests are being made with a view to utilizing some material containing iron pyrites too low in yield of sulphur to be dealt with ordinarily. A small expenditure has been sanctioned to double the capacity of a dressing plant working upon dumps and to re-open a portion of the old workings of the Glendalough and Luganure mines in County Wicklow. A mine formerly worked for antimony in the parish of Clontibret, County Monaghan, will probably be proved shortly. Boring in Ireland has been undertaken in certain areas to determine the thickness and value of cannel coal, but as yet the investigation has not reached any conclusive stage. It is estimated that the minimum quantity of coal of good quality remaining in half a dozen Irish coalfields is 300,000,000 tons. In 1916 (latest statistics available) 15,329 tons of barium compounds was mined in Ireland, 75,240 tons of anthracite, 89,833 tons of other coal, 7 tons of copper ore, 30,678 tons of iron ore, 1 ton of lead ore, and 25,035 tons of rock salt; also about 16,000 tons of barite and witherite, in regard to which it is stated that there are many large deposits that have not yet been developed. Very little zinc ore is obtained in this country. The soapstone industry is now being worked in the north of Ireland, which produces the bulk of the output for the United Kingdom. About 583,000 tons of limestone is quarried annually and used chiefly for flux in the smelting of iron ores and in the production of cement. Little has been done during the past 20 years in the way of mining pyrite. Some 2000 tons is obtained annually from Ireland, and that amount represents a little less than a fifth of the entire output for the United Kingdom. The production of bauxite, which is the principal source of aluminum, is confined to the County of Antrim, with occasional supplies from Londonderry.

Neighborliness as an Industrial Factor

By C. E. JULIHN

*In the growing complexity of industry it is easy to become confused and to get away from clear thinking as to what is fundamental in human society. I shall try to show that there is a fundamental need for neighborliness, and that it is an industrial factor of such importance as to be worthy of earnest cultivation.

We always recognize at once the need for food, clothing, and shelter, but to get these, modern society requires certain other things which may be summed up under the heading of 'communications'. Under the conditions of American life, communications have become as truly necessary as the three original necessities. There must be railroads to transport goods from the place where they are produced to the points of consumption. There must be mails, telegraphs, and telephones for the rapid exchange of human thought. There must be newspapers and journals as instruments of a great public forum in which the ideas of a hundred million people are sifted, winnowed, and weighed. I must ask you, however, to recall that man has always been gregarious; that he has never been fitted to live alone. His desire for fellowship is deep-rooted and cognate with the need of it from the very beginning of his development. In the early history of the race, man is believed to have survived largely by this trait, which is quite familiar to us as a characteristic of the lower primates. I will therefore go so far as to express my belief that there are really five, instead of three, fundamental requirements of civilized man: they are food, clothing, shelter, communications, and fellowship.

Fellowship in former times did much of the work of modern society that I have summed up under the term 'communications'. The instinct of fellowship induced human contact, which led to barter, for one thing. By meeting others and finding out what they had, primitive man learned to replenish deficiencies in his own supplies by exchange of those things he could most readily produce in excess of his needs. The more friendly a man was, the more successful he became in such transactions. Your aboriginal tradesman learned to cultivate good fellowship as a matter of business. The bright eye, good humor, and glad hand of the modern salesman has a long history, running back no doubt to a time when canny savages bartered meat for fish, or hides and ivory for arrows and spears.

You may be sure then that those racial strains have had the best chance to survive which were characterized by a strong instinct toward good fellowship. The desire for it has become literally a necessity of our natures, yet the effect of our rapid industrial development has been to diminish the observance of certain phases of good fellowship. It is no longer necessary for men to gossip in the barber-shop or tavern in order to learn the news. It may be gained more cheaply and more easily by the reading of newspapers. Entertainment and recreation has also been specialized in various ways and very notably in recent times by the development of the 'movies', which fill one kind of need for entertainment in even the most remote communities. Books have become an efficient instrument of education which often may be used to best advantage in solitude. The facilitation of local transportation by means of automobiles and great systems of electric railroads has further tended to reduce the necessity for intimate contact with those in our immediate vicinity. In the industries themselves, specialization of tasks has again greatly obscured the importance of fellowship. The factory worker spends no effort in getting the materials he is to fashion. They are supplied to him by others, who in turn specialize in just such work. His finished product is also carried away by men to whom he need not even say, "Good day, friend, I am glad to see you looking well."

Now I say to you that this tendency is wrong; that it must be combatted; that we must hold fast to the means of satisfying the human longing for fellowship of an intimate and personal kind. It is not only my wish to call your attention to this necessity and to ask your help in the furtherance of its gratification. I mean to tell you specifically how it can be done; but first I must say a few words upon the peculiar need of good fellowship at this particular time.

With the twentieth century has come an astounding climax in the economic development of man. By a steady crescendo of progress in science and invention, we have at last learned in a measure to really enjoy the fruits of the earth. The available supply of food, and its variety also, has been enormously increased over that existing in any previous period of man's existence. Of like order is the increase in the supply of clothing, shelter, and communications. Moreover, the children, of this country at least, are cared for in a way which was never before possible, and I thank God that a principal evidence of his blessing is a reasonable measure of equality in opportunity for all our children. There is not absolute equality of opportunity as yet, but there has been at least a splendid advance in this respect.

These are fundamental things of which I am speaking. Without them all the less fundamental things of life,

*An address delivered before the Lake Superior Safety Conference, at Duluth, on June 20, 1919

however beautiful, however alluring they may be, are difficult of attainment.

Those of you who have read much history have realized no doubt that the great cause of deprivation in the past has been the simple one that there was not enough of the necessities to go around and fully supply the population. As long as that was true, men had a vital personal incentive to entrench themselves within the ramparts of privilege, for it is necessary that the individual shall first guard his own life and that of his offspring before he has any power to extend help in a widening circle to humanity at large. Hence, I say to you that the mere learning how to produce goods rapidly and cheaply is the most important business of mankind at present. In this direction is the greatest hope for his happiness. From it we may expect the noblest flowering of spirituality and opportunity to attain the things which will make life most worth while to future generations. Yet, while these things should be so obvious, we are at this very time menaced by tendencies which threaten the whole structure of civilization.

A great nation until recently regarded as a leader of industry has suffered some strange psychological sickness, affecting its people as a whole, which has caused them to initiate a bloody war against their neighbors, leading to the wanton destruction of an enormous part of the world's wealth. We have been astounded to witness this horrible recrudescence of discarded anti-social conceptions. The world as a result of this war has suffered a shock from the destruction of wealth under which the very foundations of civilization have been shaken. Week after week during the awful cataclysm the labor required for the building of a Panama Canal has been wasted. The terrible effects of such prodigious loss will oppress us for a generation at least.

It should be obvious to all that the one way to salvation lies in the direction of reconstruction, in order that destroyed wealth may be replaced with greatest speed. Mankind cannot save itself from paying the price of this supreme folly by the devising of any new political or social formula. It can save itself by work alone. We therefore should have our minds centred only upon the great business of production, while holding tight to our well-tried institutions and leaving political experiments to a time when they can be tried more safely.

Yet in this time for work, and work only, we have become measurably infected by a plague of half-baked ideas that have come to us from sick Europe. I do not say this scornfully, for the unhappy serfs of Russia have my deepest sympathy in their groping for light. But I do say most emphatically that they are not fit to be our teachers. For two centuries our free institutions have caused our population to thrive and grow rich. We have witnessed a steady progress in the living conditions of the mass of our people, a progress that has kept pace with their increase in efficiency. This is our national balance-sheet. Its sum total is black ink, substantial and satisfying. Russia, on the other hand, has produced only talk. She has destroyed the organization for production and has lived awhile on the accumulation of wealth resulting from honest labor in the past. Now she is starving and preparing the way for another society of slaves and masters, because that is always the issue of a society that has not enough goods for the needs of all. It is as sure as the rising of the sun in the morning, and as the orderly progress of the seasons, that in a state of general privation, the strong and able will find means to take care of themselves, to guard their own existence, while the weak will be made to contribute to this.

It is a disheartening thing to realize how few men there are who see clearly the immateriality of political formula as compared with the vital importance of an industrial formula of "work and more work, efficiency and more efficiency" in order that mankind may have more goods and better, more food and better, more leisure for study, more energy for creating human happiness. This may be called the creed of the industrialist. I for one am in this sense an 'industrialist', and I can sincerely advise you to learn the creed and join with me in its purpose. Nothing else really matters if we hold to this great principle. A wise old Senator was once asked if he was a Presbyterian, and he replied, "No, I am just a Senator, and if I happen to have a religion, that is my own private, purely personal affair." So I would like to see this country a united nation of industrialists, holding their politics and religious opinions as subordinate personal matters.

Political formulas are not nearly as important as they are generally supposed to be. The people of India, for example, are reported to be in a state of unrest as a result of demands for freedom from British control, but if you will read that admirable book, 'The Principles of Mining', by H. C. Hoover, who was our Food Administrator during the War, you will readily see that India should rather be concerning herself with the securing of industrial education. Mr. Hoover has made a comparison of results obtained in American and Indian mines of similar character, having stoping-widths of from 4 to 5 feet, similar dip to the vein and depth of working, while all mines involved in the comparison are provided with every labor-saving device available. In the Indian mines there is an average yearly production of 69 tons per man employed, while in the American mines one man produces 713 tons, or over ten times as much as his brother in India. Is there much to wonder at that the average wage of the Americans was about $3.50 as against 20 cents for the Indians? Yet, in spite of the relatively enormous wage paid in America, the cost of its ore was only $1.92 per ton, as against $3.85 per ton for the Indian ore. Combining the efficiency indicated by the lower price per ton with that of ten times greater production there is indicated a total efficiency of the American labor 20 times as great as that of the Indian labor. Think of it, gentlemen! It seems almost incredible, but a similar tendency is always indicated by comparison of lower types of labor with higher. Yet the Filipinos and the Indians clamor only for political power. Let us suppose that the effi-

ciency of Indian labor could be increased from 1000% to 2000%, would it not be more important to the people of India than the gaining of a bauble of political independence? The answer is obvious; but I repeat that we have heard no clamor from India for an army of teachers from England.

Now in spite of our high average of intelligence, we also, like the Filipinos, the Indians, and the Russians, have a tendency to chase rainbows when substantial betterment is right at hand. American labor is the best paid in the world simply because it is worth the price, not because of anything connected with political privilege. It produces the goods with which it is paid. When more goods are produced more can be distributed as wages. I am assuming you all know wages are expressed in money merely for convenience, while real wages are the things the money buys. When the average hours of work, or intensity of individual effort, or efficient use of machinery is diminished, the output of goods decreases and less goods are produced for the paying of real wages. This economic law is inexorable, and cannot be affected by any legislation whatever.

Yet there is much talk at present of this and that political panacea which pretends to be a means of evading economic law, and many seem to believe that if just the right formula can be found it will produce marvelous results, like the casting out of devils from swine by incantation. Now, I say to you that there is no such thing possible. There will always be a jargon of political catchwords to which the answer is this: If you produce goods you will have them to enjoy and not otherwise.

When Russia learns how a man may lift himself by his bootstraps, she may find out how proclamations of high wages without the production of goods to back them up can be made to supply human needs, but until then we should faithfully hold to the good old system, which has fed us and clothed us and housed us better than any other people in the world. Let us then concentrate our thought on ways to increase our own production 1000%. Let us make our children as much superior to ourselves industrially as we are superior to the Indians. If we can do that we will have a millenium made of more substantial stuff than these Russian dreams, a millenium that will endure when the present dreams of Russia have sunk into the dim pages of history.

A Parable

*On a rather uncomfortable island a ship's crew—those who survived—were trying to get along after the shipwreck. They were going through the traditional stunts of salvaging and improving subsistence. Only the climate helped them.

But there were some difficulties other than physical—in fact, psychological.

On getting ashore, the survivors salvaged among other things the purser's safe. At first they felt some bitterness since they could neither eat nor wear the contents. But in grim jest they agreed to portion out the said contents for use as convenient tokens in the handling of their common goods—their accumulated salvage and what they might crudely produce anew on the fertile island. Their individual needs, their individual economy, and most of their individual producing or serving capacity would determine how much they should spend, should save, should acquire, as measured by these tokens.

But soon there ensued the psychological difficulties.

A good many felt that, after so sharp an ordeal in baffling death, there should be a relaxing period, of rest and recuperation and enjoyment; a little fling—in celebration.

So they used up, not merely coins and bills, but much of their subsistence in goods that these things measured. And they recontributed but a tithe of what they consumed. Yet the aggregate volume of the salt-stained currency remained constant.

Others, again, murmured at the stress of long hours and arduous toil that the wiser among them urged. Also they clamored for more, and yet more, of the tokens in return, that they might bodily enjoy more of the pleasant but dwindling stock of goods remaining or recreated—that these could command.

So it came to pass that these goods gradually—through having been scarce at first and then becoming scarcer—commanded ever more of the tokens daily.

Whereat there was puzzlement and then a sulking among many. They tended to grow envious or suspicious of their fellows, singly and by classes—those who had once sailed steerage against those who had sailed saloon. There arose disputes as to proper shares—in tokens, in goods, in effort, in time of effort.

Those who sulked declared, "We shall make these others see how indispensable we are. We shall sulk some more; then they will perceive how inflexible is our want, how imperative our will. We shall consume while we have tokens left; mayhap we shall resort to some sort of force; but we shall do nothing, and save nothing."

So the volume of life-sustaining goods—remaining and renewed—dwindled steadily. But the total of salt-stained coins and bills stayed constant; and the latter fetched ever less of the former.

Whereupon, after deep cogitation, some said, "Let us cast into the sea one-half of these tokens. Then shall our present shares of goods be instantly doubled."

Now the soil of the island was fertile, and its climate mild. But what these two things might mean was neglected, while many disputed and many more sulked, according to their class.

And the goods of all—remaining or renewed—dwindled yet more. And the power of each token shrank.

All of which was due to a strong fear—that finally strewed the island with white bones.

The fear of famine?

Nay, a jealous fear of Work, and of Abstinence!

The storm, that wrecked the ship, was War.

The island—among millions of planets—is the World.

*From the 'Boston News Bureau' of August 13.

A Monkey-Proof Crusher

The following correspondence explains itself. The first letter was addressed to the Editor, but he, feeling his incompetence, handed it to the Business Manager. The sketches in the reply from Nigeria are reproduced in fac simile, except that in the original they appear in purple ink, which heightens their effectiveness.

Jos, Northern Nigeria,
via Lagos, West Coast, Africa.
24 Jan., 1919.

The Editor:

Sir—In regard to a hand-power quartz-crusher for prospecting, please recommend me something, and, if possible, induce the makers to send me illustrated catalogues. Either U. S. A. or U. K. make. Fit for niggers, i. e., monkey-proof. 'Panklast' lever business, as used in Coolgardie, W. A., in the early days, might do. Tell me, if you will, who makes it and where.

Thanking you in anticipation,
Yours faithfully,
R. W. Hannam.

Mr. R. W. Hannam, March 20, 1919.
Jos, Northern Nigeria,
Via Lagos, West Coast, Africa.

Dear Sir:

We are completely puzzled to know just how to help you. You give practically no particulars outside of the fact, as we make out, that you want some sort of a hand-power mill for crushing quartz. We never heard of the 'Panklast', so even that clue was insufficient to give us any line to work on. The nearest to a hand-power mill is a good old-fashioned 16-pound sledge-hammer. Next to that is a single-jack. Next to that is a mortar and pestle, in which the pestle is arranged with a spring-board to help out on the return stroke. The only other suggestion that we could offer would be a small hand-operated rock-crusher, and an equally small hand-operated grinder, as are sometimes used in large assay-offices for crushing and grinding samples. Of course, the use of the word 'tonnage' in connection with such small apparatus is a misnomer. Poundage is better, and even so, if you attempt to work continuously you would probably use up your stock of niggers quite rapidly.

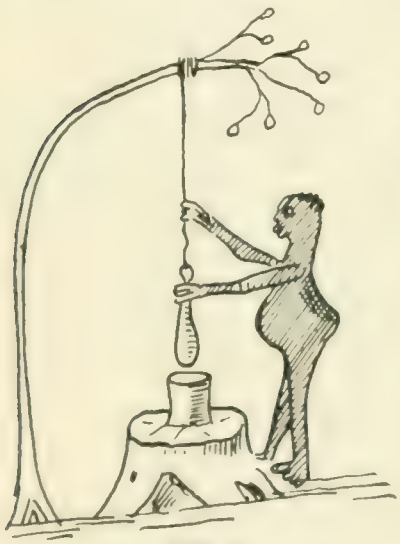


Fig. 1

We are glad to have an opportunity of serving you and hope that the information thus elicited will prove to be of benefit. Yours very truly,

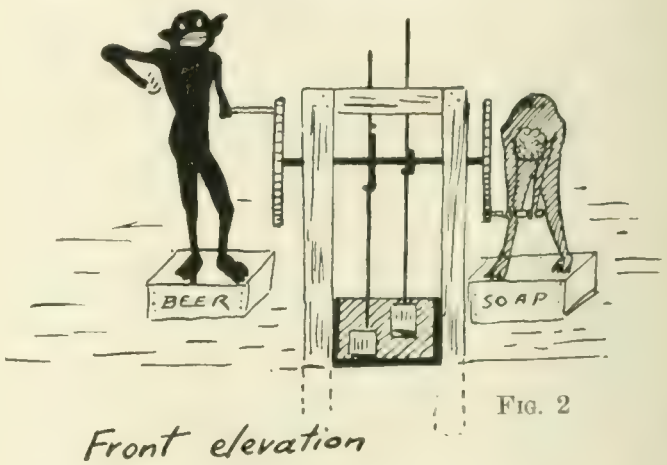
Mining and Scientific Press.
C. T. Hutchinson,
Manager.

Naraguta, Northern Nigeria,
via Lagos, West Africa.
3 May, 1919.

The Manager,
Mining & Scientific Press,
California, U. S.

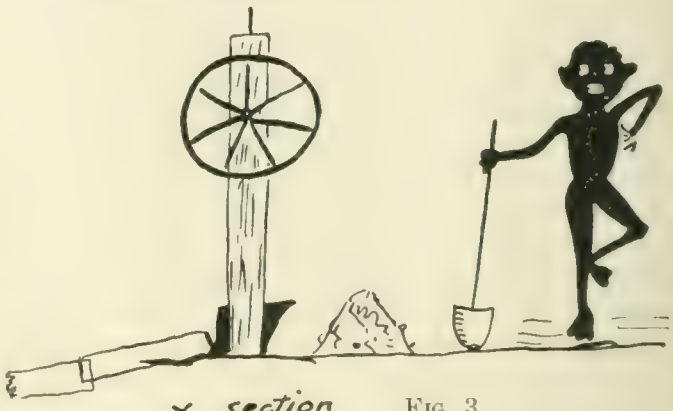
Dear Sir,

Thank you for your reply dated 20 March last to my query for a HAND-POWER QUARTZ CRUSHER and the interest you have taken in the matter.



Front elevation

Fig. 2



X section

Fig. 3

We have used the 'spring-dolly' (your pestle and mortar with spring-board). Our board was a sapling (see marginal note, Fig. 1). Three of them, more or less, in a row. No good. Too slow.

My idea was a couple of gravity stamps, lifted in the ordinary way by a cam, but by hand-power. See above, Fig. 2 and Fig. 3.

Transport is our trouble, and anyway no machine is nigger-proof. There are lots of niggers, and that's our strong point.

Should you hear of anyone manufacturing a hand or treadle mill, would you please let me know.

Yours faithfully,
R. W. Hannam.

The Cockle Creek Smelting Plant

By GUY COURTNEY

*The Sulphide Corporation's smelting equipment consists of three blast-furnaces, supplied with blast from two sets of vertical-piston blowers, each capable of delivering 8000 cu. ft. of air per minute at a pressure of 60 oz. per square inch. Each blower is belt-driven by a 130-hp. motor. The maximum speed of the blowing-engine is 35 revolutions per minute.

No. 1, the largest of the three blast-furnaces, has a crucible-area of 49.5 sq. ft., and measures 11 ft. 6 in. by 5 ft. at the tuyeres. From tapping-floor to feed-floor is 35 ft. 9 in., and this space holds, when full, 100 tons of charge. Blast enters through thirteen 3-in. tuyeres at 60-oz. pressure. Working normally, this furnace is capable of treating 300 tons of charge, exclusive of returned slag and coke, per 24 hours, with an output of 100 tons of lead. Tapped slag flows into a C. I. fore-hearth mounted on wheels, where any lead and matte are caught, and the slag overflows into a three-ton cast-iron pot, in which it is drawn away by an electric locomotive and poured over the dump.

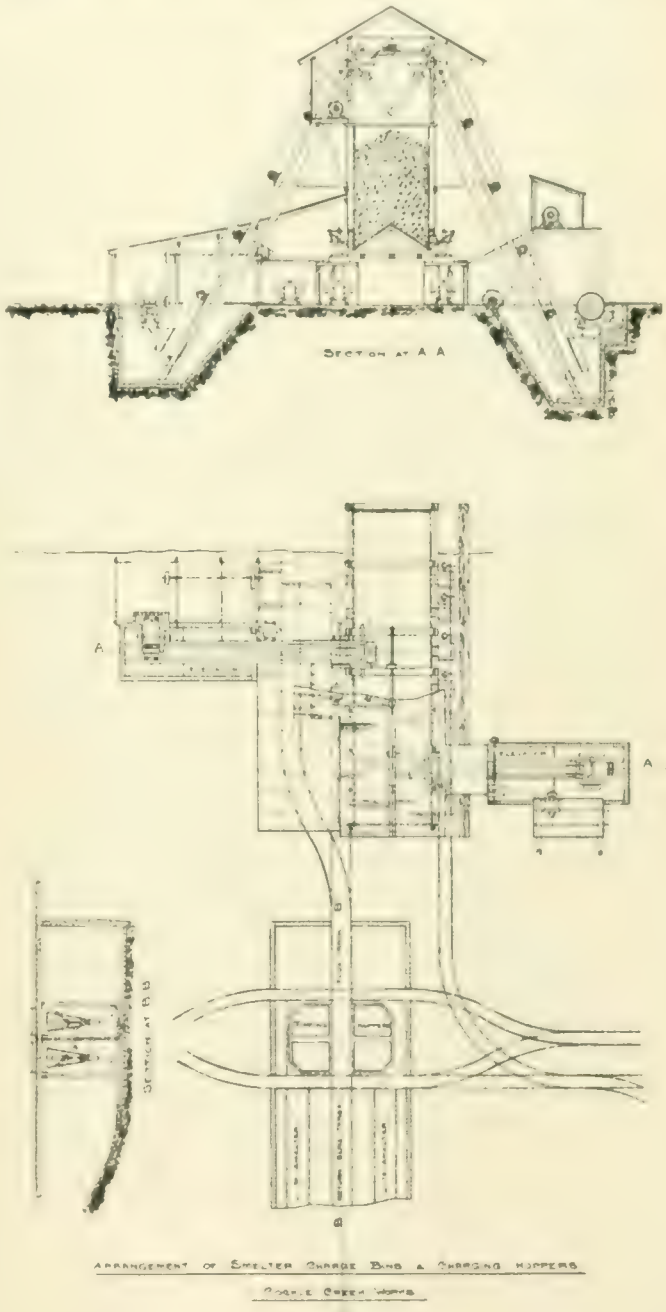
Fore-hearths are replaced several times in a shift, the full ones being taken to the matte-shed, where they are drained of matte and lead, and the shells knocked out. Any slag tapped out of these fore-hearths, together with the shell, is returned to the blast-furnace.

No. 2 blast-furnace measures 8 ft. 2 in. by 4 ft. 4 in. at the tuyeres; it has a crucible area of 29.3 sq. ft., and is 34 ft. high from tapping-floor to feed-box. Blast is delivered through nine 3-in. tuyeres at 55-oz. pressure. This furnace has a capacity of 250 tons of charge in 24 hours. The fore-hearth is similar to that already mentioned.

No. 3 blast-furnace measures 5 ft. 6 in. by 2 ft. 9 in. at the tuyeres, and has a crucible-area of 15 sq. ft. This furnace is chiefly used for smelting drosses and antimonial slags from the refinery.

In all cases the slag is taken out to the dump in the same type of slag-pot, and by the same means of locomotion. The charging arrangements consist of a series of bins, six in number, situated conveniently at the back of No. 1 furnace, and connected with all three furnaces by a 2-ft. gauge tramway system.

Two jaw-breakers reduce all materials to about 4-in. screen, and feed two bucket-elevators, which lift the fluxes and ores to the bin top, and deliver by means of movable chutes into any required bin. When full, there is enough material to last the large furnace for about 36 hours. A gang of men, working on day-shift only, keeps the bins charged. Each bin is provided with a hopper-scale, the hopper of which is divided down the centre into two compartments, so that on opening the bin-door the material is split by the partition into two approximately equal parts, equivalent to two or four charges, according as to whether the total charge has been weighed out for four or eight charges. By weighing the charges in this way, the element of error is reduced to a very small figure.



ARRANGEMENT OF SMELTER CHARGE BINS & CHARGING HOPPERS

COCKLE CREEK WORKS

Running underneath the scale hoppers is a 3-ft. track,

*Abstracted from the Proceedings of the Australasian Institute of Mining Engineers.

on which travels a special type of charge-truck, divided into four compartments by plates at right angles to one another. In order to facilitate the discharge of the fluxes, the truck is constructed on the saddle-back principle, and has a door to each of the four compartments. It is, therefore, possible to wheel four charges at once, and to discharge them independently of one another. From the flux truck the charge goes into a set of four tilting hoppers, built to the level of the floor, and over a pit in which is the truck for hauling the complete charge to the top of the furnace. These hoppers are tilted by means of hydraulic rams operated by control-levers.

The flux line runs down the centre of the hoppers, while the Huntington-Heberlein product is brought to either side and crosses at right-angles to the flux line. The H. H. mixture, which constitutes three-quarters of the full charge, is hauled from the H. H. pot-house by electric locomotives. A rake of 10 trucks, equivalent to ten charges, is brought up and run over a weighbridge, where the weight is adjusted. It is then taken on to the charge-making floor and left in position for the charge-makers to handle.

The making-up of a charge is as follows: The flux truck is run under the scales and placed in such a position that the flux, on discharging from the scale-hoppers, will split either into two or four charges, as required. Having carried out this operation with all the required fluxes, it is run down to the four tilting hoppers, and one compartment discharged into each, a charge of coke having previously been placed in the bottom. A truck of the H. H. product is then brought up and its contents dumped in, after which follows a truck of returned slag from the matte-shed, consisting of slag-pots and fore-hearth shells. The returned slag-cars are of a similar construction to the flux-wagon, except that they are not divided into four compartments, but only into the two made by the saddle.

Having completed the charge, the tilting hopper discharges into a charge-truck beneath. This truck is hauled up an inclined way to the top of the furnace by electric power, and so arranged that, as a full truck goes up, an empty one descends on the other side. On arrival at the furnace feed-floor, the feeder releases a catch, and the hopper, being slightly top-heavy, turns completely over, discharging its contents into the furnace.

The Sulphide Corporation, being a custom smelter, a large variety of ores has to be treated, resulting at different periods in furnace slags of varying composition. In consequence of this, it is difficult to give any definite type of slag run, but, as an illustration, the type being run at present is given below:

	%
Pb	0.7
FeO	36.4
MnO	1.6
CaO	17.2
SiO	24.5
ZnO	12.0

This slag, as before mentioned, is tapped into cast-iron elliptical pots and poured over the dump. The lead is tapped into small cast-iron pots, and run across to the drossing-furnace. This is a small reverberatory of about seven tons capacity, from whence two products are obtained—lead bullion (carrying most of the gold and silver) and dross. The dross, on being removed from the top of the lead, is still fairly 'wet', and is transferred to a liquating furnace, where most of the lead is sweated out and returned to the drossing-furnace. The more or less 'dry' dross is allowed to accumulate till there is sufficient to warrant No. 3 furnace being blown in, and the accumulated stock smelted. The lead from the drossing-furnace is tapped into two rings of 100 molds each, which revolve on their own axes. On cooling, the bars, which weigh about 85 lb. each, are stamped with a letter and number, in lots of 2600 bars, or nearly 100 tons, and sent for treatment to the refinery.

Lead matte, caught in the fore-hearths, is tapped into cast-steel molds, set in a revolving ring, and from thence carted to the Krupp mills at the roasting-plant, and crushed ready for incorporating in the H. H. mixture. Any lead found in the fore-hearths, which has not been previously tapped at the smelter, is cast into molds and sent to the drossing-furnace. In order to remove the shells, the fore-hearth is run into a tipping cage, which turns upside down, when, by means of a bar, the fore-hearth shell is knocked out.

The slag shells remaining in the slag-cars, after the liquid contents have been poured over the dump, are also brought back to the matte-shed, and tipped alongside the shells from the fore-hearth. A 3-ft. tramway runs through this building on a track sunk into the ground, so that the top of the return-slag trucks are on a level with the main floor. The various shells are broken up, loaded into these trucks, and drawn to the smelter-charge hopper by an electric locomotive. The only slag that is added to the smelter charge is that sufficient to keep these shells worked up.

EXPLOSIVES have been separated into the following classes according to their action: Where the material is to be displaced, but not shattered, a slow-acting explosive is required. Black gunpowder, with a velocity of explosion of 300 m. per second, is good. Blasting powder is still slower in action, and is suitable for quarrying where stone has to be obtained in large blocks. Bobbinite, still slower in action, is much used in coal mines with soft coal. All these are comparatively weak explosives, and large charges are required. Where great power and rending effect, with a moderate shattering effect, is required there is little to choose between the ammonium nitrate class and the perchlorate explosives, except that the former are the safer to handle, but most susceptible to moisture. Some grades of amatol made for military use would also be suitable, and vast quantities should now be available. Where the greatest power in the smallest bulk is required—as is the case where hard rocks are to be blasted and small drills are used—the nitroglycerine explosives are best, as they have high density, great power, and high velocity of detonation.

Crushing Practice of the New Cornelia Copper Company

By W. L. DUMOULIN

*A detailed description of the entire plant and leaching process was given in a paper recently presented to the Institute,† so this paper will cover briefly only the crushing practice of the New Cornelia Copper Co. for the year 1918.

The ore, which is mined by steam-shovels and loaded in side-dump cars, passes through two crushing-plants. The primary plant reduces to less than 3 in. and the secondary plant to ¾ in., which is sufficiently fine for satisfactory percolation of solution through the ore in the leaching-vats, and to give good extraction. The ore is then conveyed to the leaching-vats by a system of 28-in. belt-conveyors. On the way to the leaching-vats, it passes through an automatic sampling-plant, where a 1% sample is taken.

From the primary-crushing plant, the ore is conveyed by two 36-in. belt-conveyors to a 10,000-ton steel storage-bin, with a reinforced-concrete flat bottom. The ore discharges from the bottom of this bin onto four 20-in. belt-conveyors, which deliver it to the four units of crushers in the secondary-crushing plant. There is no storage-bin between the mine and the primary-crushing plant. The ore breaks coarse, is hard, and contains many boulders, some as large as 4½ by 4½ by 10 ft. long. Jams form in the bowl of the coarse crusher in the primary-crushing plant, and are freed by means of an immense steel hook operated from a 40-ton electric traveling crane. The plants were constructed to crush the ore required by a leaching-plant of 5000 tons daily capacity, during a crushing period of 16 hours.

THE PRIMARY PLANT consists of one No. 24 Gates, style K, gyratory crusher, followed by four Gates No. 8, style K, gyratory crushers. All the ore from the mine is dumped directly from the mine-ore cars, loaded with about 35 to 27 tons of ore each, into the bowl of the No. 24 gyratory. This crusher will take boulders as large as 4½ by 4½ by 10 ft. and, as first set, reduced them to 9 in. at a rate of 500 tons of ore per hour. The ore crushed by the No. 24 crusher discharges into the bowls of the four No. 8 gyratories, after passing over grizzlies with 3-in. spaces. The No. 8 gyratories took the 9-in. discharge from the No. 24 and reduced it to approximately 4 in. There are two No. 8s on each side of the No. 24, which discharge onto one of the 36-in. belt-conveyors carrying the ore to the 10,000-ton storage-bin. All crushers in this plant are belt-driven by alternate-current induction-motors.

We found that when crushing to the size indicated, the discharge from the No. 24 would flood the No. 8s; therefore, as the head is not adjustable, the bottom row of concaves in the No. 24 was replaced by a row of thicker concaves, and a new lower section of the mantle of larger diameter was placed on the head, so that this crusher now reduces the ore to approximately 6 in. This throws more work onto the No. 24 crusher and slows its rate of discharge sufficiently to give a fairly uniform feed to the No. 8s, resulting in an increase in the capacity and a reduction in wear and cost of repairs in connection with these smaller crushers. The increase in the capacity of these smaller crushers was so great that it was possible to set out the bottom row of concaves, and so obtain a produce of less than 3 in. This balances the work between the primary and secondary plants in a more economical manner. Previously, the rate of crushing in this plant was limited by the No. 8s, but now it is determined by the No. 24 gyratory, which has an average capacity of 400 to 450 tons per hour, crushing to less than 6 in., the rate depending on the proportion of large boulders in the ore crushed.

THE SECONDARY PLANT consists of four units of 48-in. Symons vertical-shaft (pillar) disc-crushers, each unit consisting of three crushers, one coarse Symons and two fine Symons. The coarse and fine Symons are identical with the exception of the upper disc, which, in the coarse crusher, has a grinding-surface 4 in. wide, and in the fine crushers 6 in. wide. Each crusher in this plant is driven by a special direct-connected 75-hp. alternating-current induction-motor having a speed of 400. As the ore is harder than anticipated, it was soon demonstrated that to crush the 5000 tons in the desired time would crowd the crushers too much for economical maintenance, so a fifth unit of three 48-in. Symons vertical-shaft disc-crushers has just been installed.

The ore from the primary-crushing plant is conveyed to the storage-bin of 10,000 tons capacity, from which it is fed to the coarse Symons at a uniform rate, and crushed to approximately ¾ in. The discharge from these coarse crushers is divided, one-half passing to each of the two fine Symons crushers in each unit, where it is crushed to approximately ¼ in. Screens ahead of the fine Symons crushers by-pass a large proportion of undersize. The capacity of a unit depends somewhat on the character of the ore, and varies from 90 to 100 tons per hour.

*Abstract of paper to be presented before the Chicago meeting of the American Institute of Mining and Metallurgical Engineers.

†H. A. Tobelmann and J. A. Potter: 'First Year of Leaching by the New Cornelia Copper Co.' February 1919.

The coarse Symons have a capacity of 100 tons per hour, crushing to ½ in. with small cost of repairs; but the fine Symons have each a capacity of only 50 tons per hour crushing to ¼ in. with rather heavy repair costs. As this type of crusher may be considered in an experimental stage for crushing as fine as ¼ in., it developed that certain parts of the machine required strengthening, when it was found advantageous to substitute cast-steel for cast-iron, as well as to otherwise strengthen this design. But even under these circumstances, this type of crusher has proved satisfactory for the service required of it and gives the most uniform product that has the minimum amount of oversize and fine. A great deal of trouble has been experienced with tramp iron in the crushers, but this trouble has been eliminated largely by the suspension of large and powerful magnets over the conveyors leading from the primary-crushing plant. These magnets were installed in addition to the magnetic pulleys already in service.

The records show that the manganese-steel wasted is as follows:

	Per ton of ore crushed Lb.
Primary-crushing plant:	
In all mantles of gyratory crushers	0.0032
In all concaves of gyratory crushers	0.0081
Secondary-crushing plant:	
In all discs of Symons crushers	0.059
Total babbitt used in each plant:	
In primary-crushing plant	0.0045
In secondary-crushing plant	0.0097

The above items are given as they represent figures on the parts most subject to wear. The power consumption of each plant per ton of ore crushed was as follows:

Primary-crushing plant	0.21 kw. hr.
Secondary-crushing plant	0.701 " "

All the preceding figures are averages for the year 1918. The total tonnage crushed during the year was 1,775,000. The following is the average screen-sizing test for the year. The samples were taken from the discharge from the fine Symons disc-crushers onto the conveyor carrying this crushed ore to the leaching-vats:

On 3 mesh	26.7	On 10 mesh	7.0
On 4 mesh	17.3	On 14 mesh	4.9
On 6 mesh	12.7	On 20 mesh	4.1
On 8 mesh	9.0	Through 20 mesh	18.3

Ore crushed as indicated by this screen-sizing test gives satisfactory results in the leaching-vats.

Helium

One of the greatest scientific and technical triumphs resulting from the application of exact knowledge and inventive genius to problems of military importance has been the large-scale production of helium, making this hitherto exceedingly rare gas available for use in balloons and dirigibles. Helium is widely distributed in nature, but generally in minute quantities. The amount of it in the earth's atmosphere is exceedingly small, being present in the proportion of only 1 volume to 250,000 volumes of air. It has been found imprisoned within radioactive mineral substances, in the gases evolved from some thermal springs, in those emanating from volcanoes, and also in the natural gas of several gas-fields in the United States (notably in Kansas, Oklahoma, Ohio, and also Texas). In some of the natural gas of this country it is present in amounts as high as 2½%. It is one of a series of rare inert gases—other members of the series being neon, argon, krypton, and xenon—all of which are present in very small quantities in the atmosphere. Thus far every attempt to make these gases enter into chemical combination has failed. Helium is, next to hydrogen, the lightest of known substances. The gas, although twice as heavy as hydrogen, has in balloons a buoyancy or ascensional power of 92.6%, as compared with the latter. The reason for this is that the buoyancy of a gas is measured not directly by its weight, but by the difference between its weight and that of the air displaced. Both hydrogen and helium are so light as compared with air that the difference in their lifting power is relatively insignificant. For example, 1000 cu. ft. of pure hydrogen will lift a weight of 75.14 lb., whereas the same amount of pure helium will lift 69.58 lb., and a mixture, containing 85% helium and 15% hydrogen, which is the gas contemplated for all-around aircraft use, will have 93.4% of the lifting power of hydrogen and will lift 70.18 lb. In its physical behavior, helium is the nearest approximation to the ideal perfect gas. It is monatomic and liquefies at even lower temperatures than hydrogen. Helium has been proved to be the end-product of the emanations of radioactive substances, but the origin of its presence in natural gas has not been established. The helium content of some natural gas is relatively so large and the radiation from radioactive material is so small that derivation from such material would seem entirely out of the question. In the whole world not more than three ounces of radium has yet been isolated; but it must be remembered that radioactive material is very widely distributed in nature and that helium generation has been going on through countless ages of past time. A great many factors enter into this question, however, and its solution is difficult. Helium is of prime importance in aeronautics because of its great buoyancy, because of its rate of diffusion and consequent wastage through fabrics being only half that of hydrogen, and, above all, because of its chemical inertness. The effectiveness of hydrogen-filled dirigibles in war, owing to the high inflammability of hydrogen, was reduced to the vanishing point when means of combating them with incendiary projectiles were developed. Even under peace conditions, the great hydrogen-filled envelope of the dirigible constitutes a serious hazard because of possible ignition from atmospheric electricity, or from flames originating in the power plant of the craft. Helium, however, being absolutely inert, cannot be ignited or exploded, and even mixtures containing certain amounts of hydrogen with helium can, as has been indicated above, be used with perfect safety in lighter-than-air craft.

REVIEW OF MINING

CALIFORNIA

NEVADA AND SIERRA COUNTIES

NEVADA COUNTY.—The machinery at the Union Hill shaft is being removed to the Idaho-Maryland ground to be put in place immediately. This is the active beginning of the long heralded operations to commence on the latter mine under the new organization, which includes the Idaho-Maryland, a one-time famous producer, and a number of other mines of lessor importance. The Alcalde company, formerly the Kenosha, west of Grass Valley, has made a beginning and soon will be bailing out the mine. The Central Consolidated on Greenhorn creek, three miles south of Nevada City, is to be rehabilitated. The mine was operated up to a couple of years or more ago with a complete 20-stamp mill, compressor, and electric hoist inside a tunnel over a shaft 1200 feet deep. Every part of the plant was removed after closing down. Supplies and a crew were sent to the mine recently for preliminary work. A boarding-house will first be constructed. John Nichols of San Francisco is on the ground and Paul W. Smith of Downieville, the former superintendent, will again have charge.

SIERRA COUNTY.—The Sixteen to One and Twenty-One mining companies at Alleghany are again in litigation and the case was set for hearing August 20 in the U. S. District Court at San Francisco. This hearing is but the continuation of a contention heretofore existing between them and supposedly settled over apex and vein formation; and although the point is apparently of minor importance it may resolve itself into a precedent. The Twenty-One company seeks to restrain the Sixteen to One people from mining along the vein, in the walls, which the defendant company claims was granted to it by a former decision from the same court, and it also claims the right to follow the vein granted by statute and to break into the walls whenever necessary during mining operations. The proceedings are in the form of an injunction. While on his way to San Francisco to appear as a witness in the case, Elisha Hampton, a well-known mining man of Nevada City, was instantly killed near Vallejo on August 20 by the overturning of an automobile. Mr. Hampton had been connected with the Alaska Treadwell, and with many other mines in Tonopah and Amador county.

Ambrose Madden, owner of the Kanaka mine, near Alleghany, recently struck a small bunch of quartz and arsenical sulphurets, twelve pounds of which netted him over $100, and he is now running a drift to intersect two veins from a 350-ft. tunnel. The three Kluffer brothers gravel claim at Poker Flat, near La Porte, has been bonded to Dan McGonigal of Nevada City. The tunnel is going ahead and new buildings are being erected before the setting in of winter.

NEVADA

THE STRIKE SITUATION.—GOLDFIELD, EUREKA, MONTEZUMA, GOLD MOUNTAIN.

With the Ely, Tonopah, and Divide mines inactive as the result of strikes and the miners of Virginia City remaining at work only at the urgent request of Governor Boyle, the labor situation in Nevada is serious. Mines in the Copper Basin district of Humboldt county also are closed as the result of a strike. In the four big districts the workers are demanding a flat increase of $1 per day. At Copper Basin they are demanding 50c., with the charge for board to remain at $1.25 per day. At Ely the operators have offered a 75c. increase, which the miners have rejected. At Tonopah, Divide, and Virginia City wage increases have been refused. In the two southern districts the operators have offered to establish a general store and sell articles at cost, with a workers' representative present to see that this is done, but the offer has been rejected. The Tonopah and Divide scale provides $5.50 for machine men doing lateral work, with $6 for men employed in shafts. The first move was made by the men of the Victory, Belcher, and Belcher Extension in the new district, when on completion of shaft work, they walked out, refusing to accept a 50c. cut for driving. The formal demand was made by the Tonopah men, with the support of the Divide miners. The result of a shut-down at Virginia City would be disastrous, as the flow of water in the deep mines of the district is heavy and a force of men is necessary to keep them in condition. There is water in only one Divide shaft, the Gold Reef, and there the flow is light. The hoist engineers did not join the walk-out in Tonopah and Divide.

Governor Boyle and Federal labor commissioners have been active in attempting to settle the trouble at Ely, and the Governor has addressed the miners at Virginia City, but without result. The labor commissioners are en route to Tonopah on request of the workers, but in view of the emphatic statement of George Wingfield, one of the largest operators at Divide, that he will close the mines he controls in preference to granting an increase, it is considered doubtful whether they will be able to accomplish anything. Miners from all districts affected,

particularly those in the southern part of the State, are entering Arizona rapidly, and one result has been the relieving, at least temporarily, of a shortage of miners at Goldfield, a junction point on the railroads leading south. The wage scale at Goldfield is the same as at Virginia City. It is estimated that 250 men left Tonopah on the first three days of the strike.

Gold Mountain.—The Washington Gold Quartz Mining Co., which has been developing on a small scale the old Randolph mine at Gold Mountain, 40 miles southwest of Goldfield, has been completely financed and, according to J. K. Turner, general manager, a large force of miners will be employed for further exploration. The Washington Gold Quartz is a reorganization of the Randolph Mining Co. and A. S. Terrell of Chicago, who is reported to have spent over $100,000 as one of the principal backers of the old company, is president of the new organization. The Gold Mountain in which the mine is situated is not the district recently renamed Divide. Both are in Esmeralda county. The Randolph company did 2200 ft. of development work and, although figures are not available, according to Mr. Turner, who has been familiar with the mine for many years, the production was large. A 726-ft. tunnel was driven in the Randolph vein and at the mouth of this tunnel a 410-ft. shaft was sunk, from which several hundred feet of driving was done. The ore is lead carbonate and sulphide and contains gold and silver. There are two grades, milling and smelting, 10 tons of the former being exposed to one of the latter. The average value of the milling ore is $15 and of the smelting ore $40. There is no ore actually blocked out in the mine, the object of all work done by the former management having been to gain depth. The formation in the district is principally granite, with some quartzite, shale, and limestone. There are three well-defined veins, the main one, the Butte Goldfield, being exposed on the surface for several miles. This vein is named from the Butte Goldfield claims, owned by a company of that name and on which a comparatively small amount of development work has been done. It has been opened at a number of places, showing a width of from 5 to 15 ft. Little work has been done in the other two veins. The new management will resume sinking the shaft and will do the first lateral work at 600 ft. The vein is leached at 200 ft., the greatest depth at which it has been opened, and it is the belief of Mr. Turner that the metallic content will be higher at greater depth.

Goldfield.—The Silver Pick has started cross-cutting into the Mohawk No. 2 claim on the 350-ft. level. Part of this claim is leased from the Goldfield Development company. The company is driving in the Silver Pick vein in this claim at a depth of 700 ft. The new work will be for the purpose of exploring the Mohawk vein under the place where ore has been found in an old lease shaft. A drift is being driven south-east in the Merger, following the fault recently found at 910 ft. Good ore was found in the drag from this fault and the drift is being driven to prospect for the source. No work has been done recently in driving the drift on the 365-ft. level of the Great Bend owing to a heavy flow of water which damaged the timbers. Repairs have now been completed almost to the face of the drift. Jack-hammer drills formerly used at the Copper Canyon mines near Battle Mountain are being used in the Florence, resulting in a reduction of operating costs, according to the Florence superintendent. The west drift on the seventh level, being driven into the hanging wall of the vein, is cutting seams of good ore. This drift will be driven 365 ft. into the wall. A south-east drift has been started from the shaft on this level to cut what R. C. McCarthy, superintendent, believes is the extension into the Florence of the Jumbo vein.

The Goldfield Development Co. is moving to the mill 9000 tons of ore broken in the Red Top and after the workings on the 165-ft. level have been cleared sufficiently, additional prospecting will be done in the hanging wall of the vein and further blasting done. Twelve 6 by 10-ft. raises have been completed in the Combination, and one furnished a surprise by breaking $25 for the entire height of 50 ft. These raises are being driven in solid rock to tap the stope filling above the 380-ft. level. A 70-ft. head-frame has been erected over the shaft through which the Combination, January, and Florence ore will be hoisted and a 500-ton ore-bin is half completed at this shaft. The bin is constructed so that additional units may be added. Two 3-ton skips, operated by a 150-hp. motor, will be used. A 1000-ton bin has been excavated at the 380-ft. level.

Montezuma.—O. R. Whitaker, O. W. Whitaker, and Harry Moon, owners of the Monitor group in the old Montezuma district, 12 miles west of Goldfield, have opened at the surface, at 50 ft. and at 100 ft. an ore-shoot 3½ ft. wide. The ore is silver-lead and assays $75 per ton. The Monitor group adjoins the patented claims of the Montezuma Mining Co., from which ore was shipped to Candelaria in the early days. Drifts have been driven in ore for 15 ft. on the 50 and 100-ft. levels. The ore is found in the farthest west of three veins striking north. Within 100 ft. of the farthest east of these veins and parallelling them is a cross-cut tunnel that enters a vein striking west. This west vein was stoped by former owners from the surface to 80 ft. and for a length of 150 ft. Turning the tunnel west, the present owners cross-cut the three veins striking north and shipped ore from all at a point 100 ft. beyond the faces of the drifts from the shaft, indicating that the ore-shoot may be this long. Starting from the surface, 87 ft. of sinking and 67 ft. of driving was done by O. R. Whitaker without assistance. A 1-hp. engine, connected with belts to a hoist made by Whitaker, was used.

Eureka.—The ore recently discovered at a depth of 900 ft. in the Eureka-Croesus has been opened to a width of 25 ft. assaying 4 oz. gold, 277 oz. silver, and 61½% lead. The ore was opened in a winze from the 400-ft. level of the Catlin shaft, on the Connolly claim. This shaft was sunk to explore the stopes in the Home Ticket and Dunderberg claims, which were producers of rich gold-silver-lead ore in the '70s, and it was by following

the opening of these stopes that additional work resulted in finding the 25-ft. orebody. The company is preparing to ship 50 tons of this ore daily. This is the third important orebody to be found through the Catlin shaft in territory not explored in the early days, and it is at least 400 ft. below the greatest depth attained by former managements in mining in this part of the claims. The production of the Eureka district came principally from the Dunderberg and Home Ticket, and it is estimated that there are from five to eight miles of workings in the former, with 1,000,000 tons of ore of an average value of over $25 per ton, much of which is stope filling. It is estimated that $100,000,000 worth of ore has been produced from the district from the early '70s, when the first important work was done, to date. Following a long period during which experiments were conducted, it has been announced that a 250-ton flotation plant is to be built, later to be enlarged to 1000 tons capacity. This plant will also treat ore from other mines, where huge quantities of low-grade ore are exposed.

OREGON

GENERAL NEWS.

Gold Hill.—The field party of the engineers and geologists of the Oregon Bureau of Mines and Geology is making its headquarters at Gold Hill for the next few weeks. The party has spent two months in the mining districts north and south of Gold Hill and during that time has examined, by request, a number of mines and prospects that are being developed and operated. Surveying, mapping, assaying, geologic study or whatever was required to assist the development of southern Oregon mines was done. Some of the better known deposits that have been thus examined in detail are the Blue Ledge (copper), the Opp (gold), the Sterling (placer gold), and the War Eagle (mercury). Several Gold Hill mines are slated for examination, after which the party will make its headquarters at Grants Pass, and later in the Waldo district. The field party is in charge of G. E. Stowell, assistant mining engineer, under the direction of H. M. Parks, director of the Oregon Bureau of Mines and Geology. It is likely that the party will return to Medford late this season.

A mining deal involving a purchase price of $50,000 was closed and filed in Josephine county recently, when a group of copper claims in the Grave Creek district, west of Gold Hill, was sold to the International Copper Co., an Arizona corporation. The payments extend, in installments, to January 1920. The proposed extensive improvements on the Almeda copper and gold mine on Rogue river, west of Grants Pass, have been suspended by reason of the revival of the litigation between rival stockholders and directors of the Almeda Mines Co. and the Almeda Consolidated Mines Co. Suit was recently started in the Federal court of Portland, when one stockholder brought the suit against the other stockholders, as well as the directors and State officials, for a complete accounting of all affairs of the two concerns. The amount involved runs high into the millions. The same litigation has been before the same court on former occasions after passing through the Courts of Josephine, Douglas, and Multnomah counties in Oregon. The plaintiff asks that the Federal court nullify the proceedings now pending in the circuit court of Josephine county, and that the entire property involved be awarded to the Almeda Consolidated Mines Co. against the Almeda Mines Co. The plaintiff charges many of the officials with fraud and deception, and alleges that the original litigation, dating several years back, was commenced as a means by which the opposing parties could procure control of the property.

MEXICO

CANANEA AND SONORA.

Cananea.—The Cananea Consolidated Copper Co. has posted notices that wages of employees will be increased to the same figure paid last December or to ₱4 and ₱5 per day for muckers and miners, respectively. This is an increase of 50 cents per day. It is currently reported in Cananea, although not yet confirmed, that the company proposes in the near future to increase its forces by the employment of about 1000 additional men in the mines, mill, and smelter divisions. There also are unconfirmed reports that the Democrata mine owned by the Hoffman interests of Cincinnati, Ohio, which has been closed for several months, will resume work soon. The

Calumet & Sonora property also is expected to go to work again within the next few weeks. The Promontorio mine of the Moctezuma Copper Co., a Phelps Dodge subsidiary near Moctezuma, Sonora, plans to resume work on high-grade copper ore in the near future.

Sonora.—In spite of washouts, which prevented the bringing of ore in appreciable quantities over the Nacozari railroad during the last week of July, the export record for that month lacked little of the usual average, according to the records of the Agua Prieta customs house. The very respectable total of 8944 tons of ore and concentrates, valued at $1,985,700, Mexican gold, was made. The statement of shipments follows: Nacozari district, 8452 tons; El Tigre, 281 tons; San Jose, 21 tons; Santa Rita, 7 tons; Granadita, 7 tons; Escuadra, 20 tons; Nuevo Potosi, 20 tons; La Nueva Amistad, 11 tons; La Cruz, 41 tons; San Pablo, 46 tons; Esperanza,

8 tons; Vetarron, 30 tons. Plans are being made for enlarging the concentrator of the Moctezuma Copper Co. at Nacozari. A flotation process may be added to the plant and tests are being run on the ore at the Copper Queen smelter, it is understood, with the idea of determining what equipment will be needed. Good reports continue to come in concerning the mining activity in the part of Sonora tributary to Douglas. At the San Nicolas in the Cumpas district, the reconstructed concentration mill, including a 50-ton flotation plant, is now in operation. The present daily output averages two tons of concentrate from about 40 tons of ore. The average grade of the concentrate is 800 oz. silver, 80% lead, and 6% copper. The concentrate is hauled by wagon to Nacozari and shipped from there by way of Douglas to the El Paso smelter. The property is operated by the Desarrolladora leasing company, of which Marion Williams is president, F. H. Fisher treasurer, Carl Knudson manager, and Leo J. Cloud director. A force of 50 men is employed. The North Tigre property, near El Tigre, is constructing a concentrator which is expected soon to be in operation. The property has large proved ore-reserves, developed during several years, which are sufficient to guarantee many years mill run at present capacity of 50 tons daily. Power for operation of mine and mill machinery will be obtained from the transmission line from the Copper Queen smelter power house which now serves El Tigre. R. D. Brown, of Douglas, is president of the company and Frank Holmes the manager. The Cinco de Mayo at Pilares de Terras, not far from El Tigre, after passing through a checkered career of several years, during which it has been operated for a time under private lease and for a time under management of officials appointed by the State of Sonora, soon will be returned to the widow of Col. Francisco Garcia, the original owner. The property was confiscated by the State government because of the alleged reactionary politics of its then owner, a former Diaz official. State operation of the property proved a costly failure, owing to poor methods employed, even though considerable rich ore was extracted. In removing the richer orebodies the waste and low-grade was left in the workings. It is stated that this method was used to such an extent that it will be necessary practically to re-open the ground from the surface in order to get at the ore. The extent of these bodies is such that the move would be justified, however, once the title has been assured. Captain Barnett, manager of the Roy mine, which adjoins the Cinco de Mayo, was in Douglas recently to report to Col. B. A. Packard, the owner, the result of a test-run made in the recently completed 50-ton mill. The test showed a recovery fully up to the expectations of Colonel Packard, but developed a few mechanical imperfections that will have to be corrected before the mill can enter continuous operation. Captain Barnett while in Douglas obtained the needed parts and by September 1 the mill is expected to be operating on the Roy's silver-lead ores. A considerable quantity of low grade for mill-run has been mined and stacked.

BRITISH COLUMBIA

GENERAL NEWS OF THE PROVINCE.

Foreclosure proceedings are to be taken against the Lucky Jim mine, at Zincton. The foreclosure is to be made on a second mortgage, amounting to $35,000. A first mortgage of $50,000 was foreclosed in 1915, and A. G. Larson was placed in charge of the mine as receiver-manager. During his tenure of office he sold some $200,000 worth of ore, making a profit of $80,000. The first mortgage was paid off, a floating debt of $14,000 was settled, and $7500 was placed in trust against the second mortgage. The mine was then closed down. Last year the capital of the company was increased from $3,000,000 to $6,000,000, but, it is stated, the accounts of the transaction seem to be in a muddle. When the present foreclosure proceedings have placed the mine in the mortgagee's hands the company will be re-organized and, according to Lendrum McMeans, who is acting for the mortgagees, every shareholder will be given an opportunity to participate on an equal basis. The Canada Copper Corporation and its employees have settled their dispute, and operations are to be resumed at once. The trouble, which lasted four months, probably will delay the starting of the new concentrator until next spring. After a dispute between the Western Fuel Co. and its employees, the company has agreed to raise the rate of wage at its Nanaimo mines 25c. per shift.

Arrangements have been practically completed by which the Canada Copper Corporation will sell the Dominion property, at Phoenix, and the smelter, at Greenwood, to citizens of Greenwood, who propose to re-start the smelter. A car of manganese ore has been shipped from Hill 60, Cowichan lake, to Tacoma, where it will be converted into ferro-manganese. This property was staked last year, and several bodies of manganese ore, running from 40 to 55% manganese, have been exposed by open-cutting and stripping. Analyses show the ore to be low in sulphur and phosphorus, but fairly high in silica. There appears to be every indication that there is a good-sized body of ore. A car of ore shipped recently from the Silver Bell mine, Kaslo creek, ran 238 oz. in silver, 31% lead, and 7% zinc.

ALBERTA

STRIKE AT CROWS NEST PASS SETTLED.—IMPERIAL OIL CO. TO DRILL NEAR LETHBRIDGE.

The Crows Nest Pass miners have voted to return to work. The miners from the Drumheller field in Alberta returned to work last week, and those at the Galt mine, at Lethbridge have voted to return. The strike has been broken none too soon, as fuel conditions in the Prairie provinces were becoming desperate.

Charles W. Taylor, chief geologist for the Imperial Oil Co., who has had 12 parties exploring in the foothills of Alberta since the early spring, has announced that a site has been selected to the south-west of Lethbridge, and drilling for oil will be started as soon as the necessary machinery can be got to the spot.

CALIFORNIA

Downieville.—C. D. McGonigal has taken the Gibraltar mine under bond from the Kieffer brothers. The tunnel is being pressed ahead to tap the main channel, and construction of surface buildings is proceeding. The Gibraltar produced well in past years.——Another shift has been added to the working force at the Brown Bear gravel mine, and development of the channel is proceeding vigorously. The channel was intersected recently, and rich gravel exposed. The company is improving its equipment and laying in supplies for the winter.——Work has been resumed at the Trinity quartz group on Spanish creek. A strong vein of milling ore has been opened and conditions are considered excellent for early production. Thomas Trinity is managing owner. The property is near Goodyear Bar.

Nelson Point.—Good ore containing payable quantities of gold, silver, platinum, and copper has been uncovered in the Gold Drift mine, according to reports from the property. The property lies three miles from Nelson Point and is being vigorously developed. The management is contemplating erecting a 20-stamp mill early in 1920. Charles A. Haas is manager.

Sawyers Bar.—Rich gold-bearing gravel has been uncovered in the Hickey Gulch property, which was recently re-located by Fred Meyers and Edward Hickey. It was discovered 20 years ago by Meyers and worked to some extent. Several small nuggets and much coarse gold has been found in the past two weeks, and the deposit appears of considerable value.

Washington.—With R. H. Conrad in charge, operations have been resumed at the Sierra asbestos mine, owned largely by Oakland residents. The ore is quarried and the fibres separated from the rock by a combination milling and separation process. Heavy shipments to San Francisco will be resumed soon.

COLORADO

Chandler.—The Chandler Petroleum Oil Co., which is drilling a well near Bumback Springs, is obtaining favorable results. At 500 ft. a small amount of oil was found, and the strata the company has been drilling in for the past 200 ft. indicate excellent oil possibilities. Geologists estimate that oil will be found in good quantities at 1500 to 1700 ft. The property has a standard rig and is well equipped to drill as deep as may be necessary. William Lloyd is president of the company and the chief shareholder. The company has been financed by 28 stockholders. In the past few weeks several different Texas and Oklahoma people have been attracted to the property by the showing that has been made, and the territory round about has been thoroughly investigated by different geologists representing them. According to those in touch with the Chandler well, these men have declared the prospects far above the average.

Denver.—Net earnings of Colorado Fuel & Iron Co. for the quarter ended June 30, after deductions for bond interest, taxes, sinking fund, and other fixed charges, were $627,154, compared with $1,700,170 for the same period of 1918, according to the quarterly statement of the company just made public. Gross receipts in the second quarter of 1919 were $10,529,414 and operating expenses were $9,385,099, leaving a net operating income of $1,144,315. Additional income from other sources amounted to $132,815. Deductions for fixed charges were $649,976. In second quarter of 1918 gross receipts were $12,812,003; operating expenses, $10,474,161, and net earnings from operations $2,337,841, while income from other sources amounted to $128,124, and deductions for fixed charges $765,966.

Grand Valley.—N. W. Bansill and M. Mulling of Las Vegas, New Mexico, directors and stockholders of the Champion Oil Shale & Refining Co., were in Grand Valley recently to consult with their local manager, J. L. Herrick, with regard to the patenting of the property in the Grand Valley shale district and the completion of the road to the company's holdings. A plant is to be installed as soon as delivered and an order has been placed in Denver for retorts and other necessary material. The Champion Oil Shale & Refining Co. also holds leases on 160 acres of oil lands in Oklahoma and 480 acres in Texas.

Kokomo.—The Star of the West group on Jacque mountain in the Ten Mile mining district of Summit county, at the present time under lease to Stillwell Connor of Denver, formerly a well-known and successful Cripple Creek district operator, has recently been examined for Chicago and New York investors holding an option on the controlling interest in the Star of the West company, owned by the estate of the late Charles J. Moore. The property is now producing and the dumps are said to contain silver ore that can now be shipped at profit. These are being sorted over by the lessee. The consideration asked has not been made public, but with a record in excess of $2,000,000 production with comparatively light development, the price is understood to have been around a million dollars.

Leadville.—The mining developments this season in the St. Kevin district are very encouraging to those interested in that part of the country. A strong leasing company has secured the Griffin property, and development work is to be carried on with a complete electrical plant, the power-line of the Colorado Power Co. being now extended to that point. The old Griffin tunnel is in over 1000 ft. and there is a good vein showing in the face. This tunnel will be driven ahead several hundred feet farther to a point where it is expected that even better results will be secured.——The New York owners of the Matchless mine on Fryer hill have determined on a vigorous campaign of development of the famous old bonanza, and operations have already started. Dr. Bailey of New York is in charge of the work. The surface plant has been put into good shape, and after necessary repairs to the shaft it is understood that sinking will commence.——The Colorado Power Co. is extending its line to the Hill Top mine, which is one of the most extensive lead producers in this part of the State.

Rico.—Ore shipments from the Rico station for the month of July were as follows: Marmatite Mining & Milling Co., 7 cars of copper ore to Durango; Valley View, 1 car lead-silver to Durango, Colorado. Total, 48 cars.

Emmett Nutter, who has been operating the Iron mine for some time, has incorporated a company named the John Doyle Mining & Milling Co., which will operate the Iron

mine from now on. It is now taking out some rich ore from a cave-in caused by a slip in the main tunnel. This ore runs as high as 1000 oz. of silver and 10% copper. It is not yet known what the slip will show with development. On the Missouri lode a tunnel has been started that is intended to cut the main orebody of the Iron mine vein. The tunnel is east of the Blackhawk tram terminal and will be about 600 ft. deep. On Expectation mountain Mr. Nutter has taken a lease and bond on the St. Louis and Bancroft claims, belonging to S. M. Ransom. He also has a lease and bond on the Iron Clad, owned by V. J. Kraft. The former claims will be worked through the Iron Clad tunnel.

IDAHO

Adair.—The Richmond Mining, Milling & Reduction Co. shipped four carloads of copper ore between August 1 and 16 and will probably increase the number to seven by the end of the month, according to J. E. Codd, president. The chief source of ore is the 260-ft. level, where a large body of mixed carbonates and sulphides is being opened by a drift and a stope, but other scenes of development are supplying their quota. The width of the shoot on the 500-ft. level has increased to five feet in the face of the drift. The ore is solely a sulphide and its quality is good. Much of it is of a shipping grade and some of it, contained in chunks, has a copper content of 30 to 35%. The ore will be sorted and what is not shipped will be saved for concentration.

THE ELM ORLU MINE

Dixie.—A. H. McKnight, president and manager of the Swastika Mines corporation, is en route to the holdings at Dixie from Washington, D. C. The Swastika has been opened by several thousand feet of workings and a large quantity of low-grade ore is reported to have been uncovered. A few gold prospects have been partly developed in the Dixie district, where some exceptional placer properties have been responsive, but, owing to the lack of transportation, it has been difficult to interest capital in them. The completion of the new South Fork highway to serve the Dixie country is expected to stimulate mining there.

Pioneerville.—The Golden Age Jr. Mining Co., in the Boise Basin country on Grimes Pass, is now working on re-concentration of 1000 tons of concentrate for shipment to the smelter, the lower grade concentrate to be cyanided on the property, using the Koering machine process. The company is also contemplating re-concentration of a tailing dump of 3000 tons, which averages approximately $8 per ton. Capital is now being raised for development work, which will consist largely of driving a tunnel 1000 ft. below the present level in order to reach the old workings. A 300-ton mill will also be erected. The present equipment consists of a 15-stamp mill. The main office of the company is in the East, and it will be financed through the Michigan Investment Co. of Grand Rapids, Michigan. Ben R. Koering is superintendent.

Wallace.—The strike at the Morning and Hunter mines at Mullan, the Hecla and the Hercules at Burke, and the Interstate-Callahan and Tamarack at Nine Mile, has been notable for the absence of disorder. The various companies maintain watchmen at the mines and mills, most of whom have been commissioned as deputies by Sheriff Scott, who has also taken other precautions to meet any emergency that may arise. So far as reported, however, there has been no disturbance and no arrests made in connection with the strike. The strike call included pumpmen and some difficulty was first experienced in keeping the pumps in operation. This was soon overcome by the companies and the mines are now amply protected. When the walkout took place about 30 men remained at work at the Hecla, practically all of whom were employed in the machine-shop and other surface work. It was stated that the number has since been increased to about double that number, but none of them is employed underground. With the exception of the Hecla all other mines affected are closed down tight. Since the strike was called it is estimated that about half the men have left the district. The issue has been reduced to the demand for eight hours "from portal to portal", and if this should be conceded it has been officially stated by the union that the strike would be called off. The mining companies, however, show no disposition to make any concessions on this point, although willing to make every effort to expedite

the movement of men to and from their work in order to reduce the time underground to the lowest limit possible. The strike was called by the Coeur d'Alene district union of the International Union of Mine, Mill, and Smelter Workers and without the sanction of the international body. For this reason it has been believed that the international would bring pressure to bear that would result in calling the strike off. Efforts are no doubt being made in that direction and there is reason to be hopeful that they will prove successful. Many of the union men were opposed to the strike and still feel that it was ill-advised and would be glad to have it called off and return to work. With the disappearance of the more irresponsible element from the district, it is hoped that the influence of the conservative element will make itself felt.

MONTANA

Butte.—The Elm Orlu case was settled on August 25, after a trial lasting four weeks, when Judge Bourquin, in the United States District Court, approved the formal decree of settlement. By the stipulation of the agreement the Elm Orlu, which is owned by the Clark-Montana Realty Co., was awarded 186 ft. additional eastward on the Rainbow vein below 1200 ft., and the Butte & Superior Copper Co. that portion above 1200 ft. The Jersey Blue vein west of a new plane below 1300 ft. is awarded to the Elm Orlu. Each side pays its own costs. Those interested may find the geology and legal points involved in an article, 'The Elm Orlu Case,' in the 'Mining and Scientific Press' for May 10, 1919.

NEVADA

Pioneer.—W. J. Tobin has returned to Pioneer to personally direct operations at the Reorganized Pioneer group. The shaft has passed the 500-ft. point and is going down in rhyolitic breccia. The shaft is expected to reach water-level at an approximate depth of 800 ft. and from this point drifts will be thrown out to reach the Pioneer vein. This orebody produced much high-grade ore above the 400-ft. level, but later faulted. Equipment includes steam-driven hoist, compressor, and mill.

Reno.—Nevada Rand Mines Co., operating in Rand mining district, has purchased a mill with capacity of 30 to 40 tons daily. The management reports a large reserve of milling ore, with good ore on the 200-ft. level. Six cars of $45 ore were shipped recently. C. G. H. McBride, of San Jose, California, is president, and W. V. Rudderow, of Reno, secretary. C. E. Hymer, of Rand, is manager.

Reservation.—Contracts have been let by the V-7 Mining Co. for sinking the new 50-ft. shaft to a depth of 200-ft. Cross-cutting will start in a short time from the 50-ft. level to reach the high-grade vein of silver-lead ore exposed in the 100-ft. shaft. The vein is 30 in. wide and samples $50 to $145 in gold, silver, and lead. E. L. and G. A. Peacock, William and B. B. Percovich, J. C. Nagel, Daniel Darnell, W. C. Walker, and George Jamieson of Oakland are heavily interested, also F. L. Wildes and W. E. Casson of Carson City, and George L. Hedges of Reservation. The last is manager.

Tonopah.—Elkton Divide Co. has been incorporated by Nevada and San Francisco people to operate in the Divide and Reservation districts. Two claims have been acquired in the north end of the Divide district, and a three-year lease taken on a claim carrying high-grade silver-lead ore about two miles from Reservation, in the Mountain View district, Mineral county. Operations on the lease are to commence about October 1. It is officially stated a good tonnage of shipping ore is exposed. C. H. Church, Tonopah, is president; E. R. Yerington, Carson City, vice-president; S. C. Jameson, Tonopah, secretary-treasurer and manager. Principal owners include F. T. and C. F. Krebs of San Francisco, and Wills Brougher and W. E. Casson of Carson City, Nevada.

OREGON

Greenhorn.—A. R. Sweet and Spokane associates have purchased the Humboldt gold mine at Greenhorn. The property is equipped and ready for operation. There is a modern three-stamp mill with heavy Merrill stamps, together with crushers and concentrating tables, all capable of handling 20 tons per day. The ore is found in a four-foot vein and runs from $4 to $20 per ton. Most of the good ore is included in two feet of the vein.

UTAH

Alta.—J. D. Lewis, manager of the Alta Consolidated, reports the company is driving a drift on the Copper Prince level along the Hoboken fissure to intersect a big bedding of copper sulphides which, it is expected, will be caught at a distance of about 400 ft. The company, he says, already has ore of the same general character, only higher grade, at other points.

Bingham Canyon.—The report of the Utah Copper Co. for the second quarter of 1919 shows an operating profit of $1,043,758, compared with a deficit of $12,948 for the first quarter. Production of copper in concentrate and precipitates from the leaching-plant for the second quarter was 28,046,978 lb., an average of 9,348,993 lb. per month, compared with 29,261,209 lb. for the first quarter. The report says in part:

During the period there was treated at the Arthur plant a total of 1,242,500 tons, being 284,000 tons less than for the preceding quarter. The average grade of the ore was 1.35% copper, as compared with 1.27% copper for the first quarter, and the average recovery was 81.80%, as compared with 74.70% for the preceding quarter, being a decided improvement. The average cost per pound of net copper produced, including plant depreciation and all fixed and general charges, but excluding Federal taxes, and without credit for gold and silver or miscellaneous income, was 11.59c., as compared with 13.72c. for the first quarter, calculated in the same way. The value of the gold and silver in concentrates and the miscellaneous income for the quarter amounted to 5.40c. per net pound of copper produced. The earnings for the quarter are computed on the basis of 14.74c. per pound for copper, as against 12.89c. for the previous quarter. The low carrying price is due to the small sales of copper made during the period and the increase in the amount of copper unsold and carried at 13¼c. per pound. The regular quarterly disbursement of $1.50 per share was paid on June 30. Operations were continued on the curtailed basis of approximately 50% of normal. The operating cost per pound of copper for the quarter is lower than it has been for a long time, fulfilling the prediction made in the report covering the first quarter of this year. During the period there was removed a total of 333,048 cu. yd. of capping, being an average of 111,016 cu. yd. per month, as compared with 379,264 and 126,421 cu. yd., respectively, for the first quarter of the year. This decrease was due to the second curtailment of operations, which took effect about March 1. A daily average of 6753 tons of ore and of 1981 tons of commercial freight was transported over the Bingham & Garfield railway, making a total daily average of 8734 tons, as compared with 13,520 tons per day for the previous quarter. This decrease was caused by the curtailment in the operations of the Utah Copper Company.

Milford.—The Gold Crown Mining Co. is now down to the 400-ft. level and contemplates going on down to the 600-ft. level. It has ore on all levels and the grade of the silver ore is rapidly increasing, the orebody becoming stronger with depth.

Park City.—Shipments from Park City during the week

ended August 23 amounted to 1414 tons, compared with 1[illegible] tons the preceding week. Among the shippers were Silver King Con., 110 tons, and Iowa Copper, 44 tons. The former, it is expected, will be a regular contributor to the camp's output from this time on, due to the finding of the orebody during the week in a raise from the incline in the Electric Light claim. Production follows:

	Tons
Silver King Con	1,180,620
Ontario	640,000
Judge M. & S.	378,680
Judge M. & S. (zinc)	100,000
Daly West	221,300
Silver King Con	220,000
Iowa	88,000
Total	2,828,600

WASHINGTON

Orient.—The First Thought mine has been acquired under an option by the First Thought Gold Mining Co., a corporation formed recently, and operations will be started when financing is complete, according to M. B. Grieve, president of the new company. "The value of the ore removed from the First Thought is in excess of $600,000, of which about half was a profit," said Dr. Grieve. "It was removed from a lens 50 ft. wide and 150 ft. long between the 100 and 300-ft. levels. The gold content averaged $16.50 per ton. Diamond-drilling from the bottom level, at a depth of 600 ft., disclosed five feet of ore at $12 per ton, according to the records. We will reach the ore by sinking a distance of 50 ft., following the course of the drill-hole. Low-grade and some high-grade ore has been disclosed in the operations of our predecessors. Tests of the milling ore have been made by Francis A. Thomson, dean of the School of Mines, University of Idaho, who says it can be dressed by the cyanide process. The mine has been opened on six levels, each 100 ft. apart, that are reached by a shaft. It is equipped with hoisting machinery and with a tramway 2½ miles long that connects it with the railroad. The property has an assay office and is perfectly equipped for the accommodation of a crew." The board of the First Thought Gold Mining Co. is composed of Dr. Grieve, president; O. J. Smith, secretary-treasurer; Joseph McCarthy, an attorney; Samuel Eslick, a contractor; and Frank Ansley, mining man. The capitalization is $1,000,000, divided into 1,000,000 shares.

BRITISH COLUMBIA

Hedley.—The Hedley Gold Mining Co., near the Washington line, earned $132,578 in 1918, according to a recent report. Dividends of $108,000 were distributed in the same period. The earnings were but $10,000 for the first two months of the year, owing to the expense of keeping the flume free of ice. The size of dividends will be reduced until the return of normal conditions, says the report. The company mined 67,313 tons of ore in 1918. The average grade of 20,028 tons was $11.18 per ton, and the average of 47,285 tons was $9.99 per ton, the latter being the lowest in the history of operations by the company. The quantity of ore in reserve is given as 263,000 tons valued at $9.40 per ton and 87,650 tons valued at $6 per ton. The value is mainly in gold.

Trail.—The Consolidated Mining & Smelting Co. received 7611 tons of ore in the first seven days of August, according to a report from its smelter at Trail, as compared with 7398 tons in the first seven days of July. Rossland is reported to be under consideration by the Consolidated Mining & Smelting Co. as the site for a concentrator.

KOREA

Unsan.—The Oriental Consolidated Mining Co. extracted $75,820 worth of gold in July.

PERSONAL

Note.—The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

S. P. Lowe is at Salt Lake City, with Chas. Butters & Co.

R. N. Dickman has moved from Florida to La Jolla, California.

T. Bruce Marriott has returned to London from South America.

A. S. Blomfield, of Colorado Springs, is on his way to Australia.

C. C. Broadwater, of the Merrill Company, has gone to New York.

H. E. Ferguson, of the U. S. Geological Survey, is at Manhattan, Nevada.

Walter E. Gaby is in San Francisco on his return from Santa Rita, New Mexico.

Howard D. Smith visited Ely, Nevada, on his way from San Francisco to New York.

J. J. Martins has returned to Oakland, California, from Chiksan, Korea, owing to ill health.

Edward H. Cook, of Culiacan, in Sinaloa, Mexico, is visiting San Francisco on his return from Denver.

J. H. Batcheller has finished the examination work at Strelna, Alaska, and has returned to Mattapoisett, Massachusetts.

T. D. Jarvis, head of the pathological department of the International Nickel Co. of Canada, was in San Francisco last week.

F. H. Newell, president of the American Association of Engineers, addressed the Engineers Club of San Francisco on August 26.

Henry Hanson has returned to San Francisco from the examination of mines at Oatman, Arizona, and Cripple Creek, Colorado.

R. L. Chase, of Denver, has returned from examining properties at Lake City and has left for the western slope to inspect oil-shale land.

F. Sommer Schmidt is now manager of the Florence Goldfield mine, at Goldfield, as well as of the Copper Canyon mine, near Battle Mountain, Nevada.

Arthur F. Taggart and **R. B. Yerxa** have formed a partnership as consulting metallurgists, with offices and laboratory at New Haven, Connecticut. They were in San Francisco last week, on their way to Miami, Arizona.

Elisha Hampton, who met his death in an automobile accident August 20, near Vallejo, California, was well known to the mining fraternity of the Pacific Coast. He was born in Cornwall, England, on February 24, 1851, and had been engaged in mining since boyhood, having worked in the mines of his native land before coming to California. Since that time he has been superintendent and associated with such properties as the Treadwell, Goldfield Consolidated, the Oneida, Central Eureka, and Bunker Hill. He retired about four years ago and resided at his old home in Nevada City. He leaves a wife, Mrs. Carrie Hampton, two daughters, Mrs. B. C. Austin of San Francisco and Mrs. N. E. Smith of Monrovia, and a son, George Hampton, of Nevada City. The accident in which Mr. Hampton met his death occurred near Vallejo while he was on his way to this city, and at the time of the accident his daughter Mrs. Smith and her three children were dangerously injured.

THE METAL MARKET

METAL PRICES

San Francisco, August 26

Aluminum dust, cents per pound	50—60
Antimony, cents per pound	10.50
Copper, electrolytic, cents per pound	24.00
Lead pig, cents per pound	6.25—7.25
Platinum, pure, per ounce	$105
Platinum, 10% iridium, per ounce	$121
Quicksilver, per flask of 75 lb.	$100
Spelter, cents per pound	9.50
Zinc dust, cents per pound	11.00—13.50

EASTERN METAL MARKET

(By wire from New York)

Aug. 26.—Copper is inactive and lower. Lead is firm. Zinc is quiet and steady.

COPPER

Prices of electrolytic in New York, in cents per pound.

Date		Average week ending	
Aug.	20	July	15 — 20.20
"	21 — 23.25	"	22 — 21.50
"	22 — 22.75	"	29 — 23.50
"	23 — 22.50	Aug.	5 — 22.87
"	24 Sunday	"	12 — 22.20
"	25 — 22.50	"	19 — 22.33
"	26 — 22.50	"	26 — 22.83

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan	29.53	23.50	20.43	July	29.67	26.00	20.82
Feb	34.57	23.50	17.34	Aug.	27.42	26.00	....
Mch	36.00	23.50	15.05	Sept.	25.11	26.00	....
Apr	33.18	23.50	15.23	Oct	23.50	26.00	....
May	31.69	23.50	15.91	Nov.	23.50	26.00	....
June	32.57	23.50	17.53	Dec.	23.50	26.00	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound:

Date		Average week ending	
Aug.	20 — 8.00	July	15 — 7.74
"	21 — 8.00	"	22 — 8.17
"	22 — 8.00	"	29 — 8.32
"	23 — 8.00	Aug.	5 — 7.64
"	24 Sunday	"	12 — 7.64
"	25 — 8.00	"	19 — 7.86
"	26 — 8.00	"	26 — 8.00

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	9.75	7.78	7.44	July	8.98	8.72	7.78
Feb	10.45	7.97	6.71	Aug.	8.58	8.87	....
Mch.	10.78	7.67	6.53	Sept.	8.33	9.58	....
Apr.	10.20	7.04	6.49	Oct.	8.32	9.11	....
May	9.41	7.92	6.43	Nov.	7.76	8.75	....
June	9.63	7.92	6.91	Dec.	7.84	8.49	....

LEAD

Lead is quoted in cents per pound, New York delivery.

Date		Average week ending	
Aug.	20 — 5.85	July	15 — 5.42
"	21 — 5.85	"	22 — 5.62
"	22 — 5.90	"	29 — 5.91
"	23 — 5.90	Aug.	5 — 5.87
"	24 Sunday	"	12 — 5.64
"	25 — 5.90	"	19 — 5.68
"	26 — 5.90	"	26 — 5.88

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan	7.64	6.85	5.60	July	10.93	8.03	5.53
Feb.	9.10	7.07	5.13	Aug.	10.75	8.05	....
Mch	10.07	7.26	5.24	Sept.	9.07	8.05	....
Apr	9.38	6.99	5.05	Oct.	6.97	8.05	....
May	10.29	6.88	5.04	Nov.	6.38	8.05	....
June	11.74	7.59	5.32	Dec.	6.49	6.90	....

SILVER

Below are given official or ticker quotations, in cents per ounce of silver 999 fine. From April 23, 1918, the United States government paid $1 per ounce for all silver purchased by it, fixing a maximum of $1.01½ on August 15, 1918, and will continue to pay $1 until the quantity specified under the Act is purchased, probably extending over several years. On May 5, 1919, all restrictions on the metal were removed, resulting in fluctuations. During the restricted period, the British government fixed the maximum price five times, the last being on March 25, 1919, on account of the low rate of sterling exchange, but removed all restrictions on May 10. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the normal rate of exchange.

Date		New York, cents	London, pence
Aug.	20	111.50	59.87
"	21	110.00	61.25
"	22	111.75	60.37
"	23	112.25	60.50
"	24 Sunday		
"	25	113.25	60.75
"	26	113.25	61.25

Average week ending		Cents	Pence
July	15	106.46	53.38
"	22	104.85	54.25
"	29	106.54	54.99
Aug.	5	108.08	55.17
"	12	110.58	58.02
"	19	112.68	59.14
"	26	112.00	60.66

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	75.14	88.72	101.12	July	78.92	99.62	106.36
Feb.	77.54	85.79	101.12	Aug.	80.40	100.31	....
Mch.	74.13	88.11	101.12	Sept.	100.73	101.12	....
Apr.	72.51	95.35	101.12	Oct.	87.38	101.12	....
May	74.61	99.50	107.23	Nov.	85.97	101.12	....
June	76.44	99.50	110.50	Dec.	85.97	101.12	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. Prices, in dollars per flask of 75 pounds:

Date		Aug.	12 — 105.00
July	29 — 105.00	"	19 — 105.00
Aug.	5 — 105.00	"	26 — 100.00

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	81.00	128.06	103.75	July	102.00	120.00	100.00
Feb.	126.25	118.00	90.00	Aug.	115.00	120.00	....
Mch.	113.75	112.00	72.80	Sept.	112.00	120.00	....
Apr.	114.50	115.00	73.12	Oct.	102.00	120.00	....
May	104.00	110.00	84.80	Nov.	102.50	120.00	....
June	85.50	112.00	94.40	Dec.	117.42	115.00	....

TIN

Prices in New York, in cents per pound:

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	44.10	85.13	71.50	July	62.60	93.00	70.11
Feb.	51.47	85.00	72.44	Aug.	62.53	91.33	....
Mch	51.27	85.00	72.50	Sept.	61.54	80.40	....
Apr.	55.63	88.53	72.50	Oct.	62.24	78.82	....
May	63.21	100.01	72.50	Nov.	74.18	73.67	....
June	61.53	91.00	71.83	Dec.	85.00	71.52	....

FOREIGN EXCHANGE

During the week serious further declines occurred in foreign exchange, but good recoveries have since been made so that, as fluctuations are measured these days, the position on August 26 is not much worse than a week ago. Sterling at 4.12¾ on August 20 established a new low record, but the recovery has been almost complete. This low record may have been caused by the current inflooding of bills being augmented by the letting go of some that had been held back in the hope of a recovery. The delay in definite formulation of credit relief plans and the Lloyd George remarks may have added to the discouragement in such quarters. The vital issue of credit extension is still in the discussion stage. Only specific items rather than a general plan have so far emerged, the latest development reported being a project for a $200,000,000 loan to France. There is not much doubt that twice that amount could well be employed in this single direction. The difficulty of the situation was brought out by recent remarks of Mr. Stettinius in Paris to the effect that American exporters were showing "no wild enthusiasm" in the matter of long-time credits. It is a plausible surmise in New York that Mr. Morgan's impending departure for Europe, although ostensibly for pleasure, will not be unrelated to the exchange problem.

Gold. Gold for exchange purposes has practically ceased to move from this country. During last two months, since the embargo on shipments of gold was removed, gold coin and bars aggregating $128,787,500 have left this country. The movement has taken several directions. The most extensive one has been to South America, which has taken $57,200,500. Asia has been a close second, taking $30,832,000 for Japan, $20,423,000 for China, and $500,000 for India, making an aggregate of $51,755,000. Movement of gold to Europe practically ceased a month ago when gold stopped flowing from this country to Spain. Since then there have been only shipments of approximately $500,000 to France and $200,000 to England. At the time the embargo was lifted, certain bankers predicted total shipments of gold for exchange purposes would be in the neighborhood of $100,000,000. That this prediction has proved too true will be readily seen when it is noted that with the exception of the gold flowing to the Far East, the movement has practically ceased, and, if we deduct from the full aggregate the gold shipped to China, because it will not be used directly for exchange purposes but will be worked up, it is found that $108,364,500 is the extent of the gold movement. Small shipments to South America will continue for a time, but the flow of gold from this country, except to the Far East, appears to be practically over for the time being.

Quotations on August 26 are as follows:

Sterling:	Cable	4.22
	Demand	4.21
Francs:	Cable	8.03
	Demand	8.05
Lire:	Demand	9.52
Marks		1.00

Eastern Metal Market

New York, August 20.

All the markets are more active and prices have in most cases advanced, the recent dullness having disappeared.

The outside market in copper has approached that of the leading producer and quotations are strong on better demand.

Quietness characterizes the tin market with spot tin in better supply and prices consequently lower.

The lead market is higher, the outside quotations and that of the leading interest being nearly the same. Demand is good.

Zinc prices have advanced along with those of copper and the tone is strong.

Antimony is quiet but strong.

IRON AND STEEL

The prospect of an extended strike in the steel industry is the important topic, but it is the opinion of 'The Iron Age' that a general and long continued stoppage of production is not now indicated and that in some quarters it is known that the results of concentrated efforts of organizers in the last two months have been disappointing. Exports of American steel are at a high rate with August orders equal to the June and July record, which represented the full 10% of the product of the independent steel companies which they agreed upon as their export business. There have been recent advances in the foundry pig-iron market. The Carnegie Steel Co. bid 2.50c. on nearly 30,000 tons of plates for battleships but other bids were $3 per ton higher or at the March 21 schedule. No awards have been announced on the 100,000 tons of rails for the Railroad Administration.

COPPER

The declining tendency of the past two weeks has given place to a stronger tone. In the last week prices have gradually risen until they are about 2c. higher than a week ago. Today electrolytic copper in the outside market is quoted and sold at 23.50c., New York, for early delivery with futures about ¼c. higher for each month beyond September. Lake copper is about 24c., New York, for the same position or at an advance of ⅜ to ½c. over electrolytic. There have been several causes for the change in front of the market position. Most of the metal in second hands has disappeared and nearly all the important strikes in the brass and other industries using copper have been settled. There is also a growing appreciation of the fact by consumers and producers that costs are likely to be higher instead of lower, to which a not improbable increase in freight rates will contribute. There is also a prospect of a large foreign demand later as well as the difficulty of increasing production because of labor scarcity. Demand for last quarter is heavy and there is also considerable inquiry for first quarter delivery. Producers are still firm in their quotations of 23.50c. for September-October delivery and are reluctant to sell beyond these positions.

TIN

After standing around 70c., New York, for many months, spot Straits tin has at last fallen in price and today can be purchased around 56 to 58c., New York, which is quoted as the market. It is true that only small amounts are thus far obtainable but with the large quantities probably afloat it is not unlikely that it can in the near future be obtained freely. The cause for this is the arrival in the last week or so of several hundred tons from England which, while consigned to consumers in most cases, was re-sold by a few who purchased it, probably at lower levels, a short time ago. There was also considerable Lamb & Flagg tin received. Reports show that there are 5480 tons of tin afloat of which 2050 tons is from the Straits and Australia. Arrivals for the month to August 15 have been 2630 tons, of which 1930 tons came in at Atlantic ports—the largest at these ports for many months. The market has been very quiet on the surface, but there have been fair sales for last quarter delivery from the East—probably 75 to 100 tons per day in the last week.

LEAD

The outside market is considerably stronger and its prices have nearly approached that of the American Smelting & Refining Co. which still quotes 6c., New York. The cheap outside lots have nearly all been absorbed and today it is almost impossible to buy lead under 5.90 to 5.95c., New York, and it is stated that some sales were made at 6c. in the outside market yesterday. There is some prospect of a strike of miners in the Missouri districts and this prospect has tended to advance prices, production not being on a large scale in the industry.

ZINC

Almost daily in the past week prices of zinc have advanced until today prime Western for early delivery cannot be bought for less than 7.75c., St. Louis, or 8.10c., New York, which we quote as the market. The change in the condition of this market is due in large part to the better tone of the copper market as well as perhaps the lead. Demand is better from the brass makers for this reason. Another factor affecting values is the appreciation of the fact that output is now estimated at only 30,000 tons per month, as compared with 45,000 tons per month in 1918. The tone of the entire market is strong.

ANTIMONY

The market though quiet is strong and slightly higher at 9.25 to 9.37½c., New York, duty paid, for wholesale lots for early delivery.

ALUMINUM

Quotations are 32 to 33c., New York, for wholesale lots for early delivery of No. 1 virgin metal, 98 to 99% pure.

ORES

Tungsten: Not very much business is reported but quotations range from $7 to $10 per unit in 60% concentrates with some Western producers quoting $15. It is reported that demand for ferro-tungsten is better, which some makers quote up to $1.20 per lb. of contained tungsten, but it is claimed by some buyers that as low as $1.05 can be done.

Molybdenum: Quotations are nominal at 75c. per lb. of MoS_2 in 90% material but no business is reported.

Manganese: Very little if any business is recorded with quotations nominal at 50 to 60c. per unit for foreign ore at seaboard. The market is weak due to the recession in ferro-manganese values.

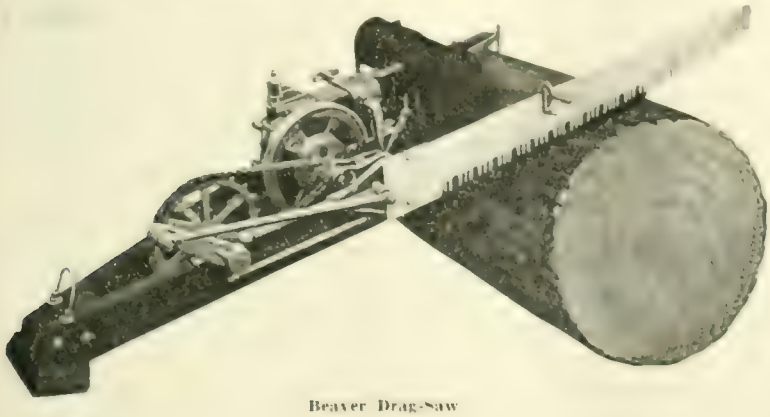
Manganese-Iron Alloys: The ferro-manganese market is dominated by the offering of British alloy, which is obtainable at $100 to $105, seaboard, depending on the seller. American makers still quote $110 to $115, delivered, but would doubtless meet British competition where necessary. Spiegeleisen is quiet at $35, furnace, for 20% alloy.

INDUSTRIAL PROGRESS

INFORMATION FURNISHED BY MANUFACTURERS

PORTABLE POWER DRAG-SAW

A portable power drag-saw marketed by Harron, Rickard & McCone, of San Francisco and Los Angeles, has done much to lighten the burdens of timbermen, ranchers, wood-cutters, contractors, and all others who cut timber into short lengths. The first of these saws, equipped with 2-cycle engine, was put on the market four or five years ago. Since that time many new and improved machines have been developed. The first big improvement was a free-engine clutch, which allows the engine to be started without running the saw-blade. When the engine is cold it can be easily started by throwing the clutch out and relieving it of all load. The latest improvement is the 4-cycle engine, which weighs but 10 lb. more than the 2-cycle. It has many advantages over the old 2-cycle type. Under the worst conditions it will use only two-thirds as much gasoline, and under favorable conditions only half as much. But above all it is reliable, and to give results does not require the fine adjustment of the 2-cycle to keep on pulling its load. For this reason it can be used on other work as well as operating the saw.



Beaver Drag-Saw

These machines can be operated and moved on the log by one man and carried from log to log by two men. Consequently, thousands of farmers have taken to them during the past few years, thereby solving the problem of fuel shortage. Contractors use them for clearing right-of-way and cutting timber into exact lengths, and loggers use them for cutting fuel for their donkey-engines and locomotives, as well as on the pond for cutting timber into shorter lengths.

NEW OLIVER FILTER CATALOGUE

The Oliver Continuous Filter Co., San Francisco and New York, has issued Bulletin 12, a new catalogue which gives in attractive and useful form the latest developments and improvements in the Oliver filters and auxiliary equipment. For the benefit of those unfamiliar with these filters, their general construction and uses are first described, including the filtration and washing of ore slimes resulting from cyaniding, the de-watering of flotation concentrate from copper, lead, and zinc ores, the complete removal of copper solutions from oxidized copper ore slimes that have been leached with sulphuric acid, and many other filtration uses in the manufacture of beet sugar, caustic soda and other chemicals, dyes, paints, starch, and gluten. The wide range of materials handled by Oliver filters is given in a list of over 80 products. This is followed by a table of standard sizes, and a short description of capacities with different materials. The advantages of the Oliver filters and details of construction are then given, illustrated by both diagrams and photographs. The operation of the filters and necessary auxiliary equipment receive a suitable amount of space. The art of filtration is next discussed clearly and at length, grouping all existing types of filters under four heads and discussing the advantages and disadvantages of each type. This is followed by a description of vacuum pumps and compressors, both reciprocating and centrifugal, speed reducers, and the Oliver sand-table filter. Special filters, such as for laboratories and technical schools, and for acid solutions, are adequately treated. The bulletin closes with a brief summary of the products manufactured by the Oliver company, an incomplete list of Oliver installations, and a statement of Oliver service in the way of laboratory tests and engineering on erection. This new catalogue, of which the illustration shows the front cover, is attractively illustrated

and well printed on good paper. It treats clearly the filtration problem and the way in which it has been solved by the Oliver filter, and will be most useful to those interested in filtration.

COMMERCIAL PARAGRAPHS

The Edison Storage Battery Co. announces the removal of its Pittsburgh office to Room 431, Union Arcade Bdg.

The Chicago Pneumatic Tool Co. announces the appointment of J. L. Canby as district manager of sales at Chicago, succeeding Nelson B. Gatch, who has been transferred to New York as district manager of sales.

The Pelton Water Wheel Co. of San Francisco has issued Bulletin No. 12 on Pelton water wheels. Many of the standard types of wheels and enclosed motors are illustrated and described, together with water wheel accessories and illustrated examples of the many applications to which this wheel is put. Engineers and mine managers will find this a valuable publication especially for the engineering information contained therein.

The Sullivan Machinery Co. announces the appointment of R. S. Weiner as district manager at El Paso, Texas, succeeding Don M. Sutor. Mr. Sutor has been transferred to the company's St. Louis office as district manager for Missouri, eastern Texas, Oklahoma, Kansas, western Kentucky, and western Tennessee. The company's office at El Paso remains at room 511 Mills building, as heretofore.

The Overstrom Manufacturing Co. announces that its Los Angeles factory and offices have been closed, the factory having been moved to Berkeley, California, where it will be more closely in touch with and directly under the supervision of the main office of the company in San Francisco. The company therefore requests that all communications, inquiries, orders, etc., regarding Universal concentrating tables, for use in the United States and its possessions, be sent to the Overstrom Manufacturing Co. at its main office, 1215 First National Bank Bdg., San Francisco.

Booklet No. 118, entitled 'Drills,' has just been issued by the **Sullivan Machinery Co.**, Chicago. This little pamphlet of 32 pages is published to illustrate and describe briefly an efficient drill for every kind of rock excavation, in mine, quarry, or on public work. The illustrations show the different drills both in detail and under working conditions, and are accompanied by specifications and brief statements of the work for which each type is best suited. With each drill is given a reference to a Sullivan Bulletin that describes it in greater detail. Submarine drills, diamond-drills, drill-sharpeners, and air-compressors are also described briefly.

An electric apparatus for detecting small power losses and so determining the efficiency of gears has recently been perfected by C. M. Allen, Professor of Hydraulic Engineering at the Worcester Polytechnic Institute. A number of tests were made with this apparatus to determine the best sort of gear lubricant. The best results were obtained with a mixture of heavy oil and flake graphite. With a perfect blending of the oil and graphite there was a minimum loss through friction. The **Joseph Dixon Crucible Co.**, Jersey City, N. J., claims that this test proves that flake graphite properly combined with oils and greases is unexcelled because of its ability to build up microscopic irregularities in gear surfaces, forming a tough film of graphite, and so preventing metal-to-metal contact.

'C-H Mine Duty Apparatus' is the title of a new 8-page 8½ by 11-in. booklet just issued by the **Cutler-Hammer Mfg. Co.**, Milwaukee, Wisconsin. This new booklet makes special reference to the mine duty apparatus installed in the plant of the St. Louis Smelting & Refining Co. at St. Francois, Missouri. A detailed description is given of the method of handling the ore from the three levels of the mine until it is ready for shipment. Special emphasis is laid on the hoist and conveying machinery and the C-H automotic control and safety apparatus used on this machinery. The pamphlet is attractively illustrated, showing the mine-hoist control panel, master switches, limit switches, overspeed governors, and electrically operated brakes, as well as the automatic starters for the crushers and conveyors. These starters are controlled from push button stations and the speed of the conveyors and crushers is governed by armature regulators. The front and back covers of the booklet display a panoramic view of the buildings above the mine, including everything from man-hoist to chat dump.

The Bonnot Co., Canton, Ohio, has issued an illustrated catalogue describing the Holbeck pulverized coal systems. Many of the data presented therein are of an informative nature. A novel method of illustration is used in the form of perspective drawings of pulverized coal plants, showing in detail the various units completely assembled. The catalogue is profusely illustrated with photographic reproductions of actual installations, showing the wide variety of application for this method of burning coal. Illustrated descriptions are given of the various individual pieces of apparatus that enter into the equipment of complete plants. It is evident that the Bonnot Co. has taken unusual care and thought toward providing for any contingency, however remote, that might interfere with successful continuous operation. Automatic mechanical handling of the coal from the time it enters the receiving bin to the performance of its function as fuel are characteristic of the Holbeck system. Engineers, designers, and mine and smelter managers will find this publication useful in helping them toward a better understanding of the use of pulverized coal as a fuel. Copies of this catalogue will be sent gratis upon application.

The transcontinental trip of two complete U. S. Motor Transport Corps companies of war strength, consisting of 42 army trucks, which started from Washington on July 7, is receiving an enthusiastic welcome at all points along the Lincoln highway. The trucks are scheduled to arrive in San Francisco on September 1. Detailed road maps of each State to be traversed and national highway maps were supplied by the National Touring Bureau of the **B. F. Goodrich Rubber Co.** The army truck train is as follows: 5 passenger cars, 35 trucks, all of army types, 2 ambulances, 6 motorcycles, 2 tank trucks, 2 kitchen trailers, 2 water tank trucks, 1 engineer shop truck, and 1 searchlight truck. Technical personnel from the motor transport corps, engineer corps, medical corps, field artillery, and air service are making the journey. According to Brig. Gen. Charles P. Drake, chief of the Motor Transport Corps, the purposes of the long trip will be to provide service and performance tests of various types of army motor equipment, to collect data to be used in connection with the technical training of the personnel of the M. T. C., and to provide an opportunity for extensive study in terrain observation, to demonstrate the practicability of long distance commercial motor truck transportation, and to point out the necessity of governmental appropriations to assist in the continuous improvement of all through connecting routes in the United States, to provide an opportunity for procuring recruits for the Motor Transport Service. The convoy is under command of Colonel A. Owen Seaman of the General Staff who will have charge as far as Salt Lake City, Utah, at which point General Drake will take personal command. Service stations and branches of the Goodrich company, whose equipment is on a number of the passenger cars and trucks of the army motor train, will render expert tire service along the route from coast to coast, where the occasion demands.

CARNEGIE'S bequest of annuities of $10,000 to Mr. Taft and to Mr. George, and of $5000 to the two widows of ex-Presidents, is one of the most gracious things he ever did. The British Premier will be entitled to a pension and he may decide that it is improper for him to accept the bequest of his American friend, but the other annuities suggest once more that some statutory provision should be made for the President of the United States when he retires from office.

RARELY does a daily newspaper publish an article on a technical subject worthy of being re-printed in a technical journal, but the 'New York Times' is a great newspaper, probably the best in our language, so we were not surprised to read an article on deep well-sinking in its issue of August 21 and to find that the article was an exceptionally good one. We give it to our readers on another page. It must have been based upon first-hand information, probably from the office of the State Geologist of West Virginia. The only part of the article that is open to correction is that in which the depth of the deepest mines in the world is given. This is not quite up to date, as many of our readers will note. The deepest shaft is that of the St. John del Rey, a gold mine in Brazil, which is now 6326 feet vertically below the surface and is likely to be further deepened, despite the difficulties of temperature (116°F.) and ventilation. For many years the No. 5 shaft of the Tamarack copper mine, which is 5368 feet deep, held the record, but it is far behind now and is shut-down, as are the deepest mines of Pzribram, in Bohemia, and of Bendigo, in Australia.

AMONG the articles we publish this week is one by Mr. Lloyd C. White, who describes the No. 1 concentrator of the Mountain Copper Company, with which he was connected as metallurgical engineer before his recent entry into partnership with Messrs. Albert Burch and Oscar H. Hershey, in San Francisco. Mr. P. B. McDonald, who writes on the guild system, was formerly on our editorial staff and is now in New York. Mr. C. A. Grabill, of Berkeley, has recently returned from South America and gives some useful hints on the buying and selling of ore in Chile. Mr. Chester W. Purington, formerly on the U. S. Geological Survey and since then prominent in the technical direction of mining enterprises in Siberia, is particularly well informed concerning the mining industry of Asiatic Russia. The article that we print was contributed originally as a series of contributions to the 'Echo' of Vladivostok.

UPON another page we publish a short review of an old book on Cornwall by Mr. J. C. Murray, formerly editor of the 'Canadian Mining Journal' and a writer well known on both sides of the frontier that has no guns or fortifications. In the antique phrasing and quaint spelling of Richard Carew's volume the reader will find many examples of archaic English, and he will recognize some of the terms used by the Cousin Jacks, who have played so useful a part in the mining development, for example, of the Lake Superior copper mines, of the gold mines of Gilpin county in Colorado, and of Nevada county in California. The gold that "they kept in quills" recalls the use of 'pure quill' to express richness of ore; we are reminded also of the fact that the pioneers from Georgia who first prospected Cherry Creek, near Denver, in 1849, put the gold they found into quills made from the feathers of wild geese. The Cornish cherished the fallacy, as old as mining, that veins and lodes increase in size and richness the deeper they are followed. They did it out of a meagre experience; our modern promoter does it in the face of a vast array of contrary testimony. The reader will find many delightful touches in the quotations given by Mr. Murray and will join us in thanking him for this pleasant diversion from the beaten ways.

COBALT is the latest mining centre to suffer from the prevalent industrial unrest. The strike of the miners, after many premonitory rumblings, finally broke forth on July 23, when 2200 men stopped work. The Cobalt Miners Union, which called the strike, is acting under the leadership of the Western Federation of Miners, and that is the point that seems to have prevented a peaceful adjustment of the difficulty. The issue has not been wages or profit-sharing or living conditions, but the old dispute over the recognition of the union. The mine operators on their side have organized to form the Temiskaming Mine Managers Association, and at the present writing the deadlock is complete. The pumps have been withdrawn from the mines, which are being allowed to fill with water. Apparently the Managers Association has decided that the issue must be fought out sooner or later, and that nothing is to be gained by delaying set-

tlement. Meanwhile the Great War Veterans Association has taken a hand. This organization, if it can manage its affairs in wise and orderly fashion, has great possibilities for influence on Canadian public questions. In this instance it seems to be throwing its weight on the side of breaking away from the Western Federation of Miners and forming a new union, with which, presumably, the Managers Association would not refuse to deal. The chief stumbling-block in the whole trouble is the reputation of the Western Federation of Miners. Senator Robertson, the Minister of Labor, who made many attempts to prevent the strike by conciliatory methods, and has, since it started, tried vainly to settle it by arbitration, states that the Western Federation is under new leadership, that the men whose lawlessness brought it into evil repute are gone, and that at the present time, in insisting upon its recognition as the power behind the Cobalt Miners Union, it is merely insisting on the right of collective bargaining; he says that much might have been done with a little yielding on the part of the mine managers, and bewails their unfortunate obduracy. On the other hand, the Minister has been criticized as helping to precipitate the strike by showing sympathy in favor of the labor leaders, who felt that, through him, they had the Government back of their demands. The mine managers insist that the leopard cannot change his spots, and refuse to deal with any union affiliated with the Western Federation of Miners. It is hoped that the Great War Veterans Association may be able to adjust the difficulty, although its efforts have not yet been attended by much success. A committee of returned soldiers has asked to be relieved of its duties, stating that the feeling of distrust is still too great for mediation, and prospects are not bright for a speedy settlement. Grave suspicion exists that the grievance of the men, who, during the visit of the Royal Commission on Industrial Relations in May, seemed among the most contented workers in Canada, is not justified, and that the whole affair is the attempt of the unscrupulous leaders of the union to stir up trouble in a peaceful community and capitalize to their selfish advantage the present unrest of industry.

WE learn, with interest and sympathy, that the scientific and technical staffs of the U. S. Geological Survey have been impelled to call a meeting to protest against the order of the Public Building Commission reducing by one-half the space available for them in their quarters in the New Interior Building at Washington. Our readers need not be told of the value of the work done by these men in behalf of the mining industry; the industrial, social, and economic progress of a country like ours is largely measured by its capacity to encourage scientific research and to place the results in the hands of those by whom they can be applied to utilitarian purposes. The Geological Survey draws its staff from among the best educated men in the community, from men of the highest ideals and the keenest intelligence. They are deserving of considerate treatment by their employer, the Government. After thirty years of the most efficient service the Geological Survey found itself housed under crowded and insanitary conditions, so prejudicial to efficiency as to menace its standard of work and endanger the health of its staff. A protest to the Public Health Service resulted in the preparation of plans for a building specially adapted to this scientific bureau, and in 1913 a bill was passed by Congress authorizing the construction of the New Interior Building, of which the Survey now occupies one-third. The present personnel of the Survey includes 320 geologists, engineers, chemists, and other technical employees, besides 260 on the clerical staff and 121 skilled mechanics and workmen. By the proposed reduction in allotted space the first two groups, aggregating 580, must do their work in 20% less floor-space than that occupied by them in their former crowded and insanitary quarters. It is said that the reduction in space is made in the interest of economy; it may be economical but it is not economic; it is the kind of cheapening that defeats its purpose. The health and comfort of the worker is a matter of immediate practical importance; it is particularly important in the case of brain-workers, who, to be at their best, require quiet, freedom from interruption, proper lighting and ventilation, easy access to books of reference, drafting-tables, room for maps and specimens, and other special equipment. Packing technical investigators like steers in a cattle-car is a huge mistake; the scientific worker is worthy of more than his hire; he is entitled to the best consideration of his employer, more particularly of an employer who represents the Nation. These men are under-paid; most of them receive less than the unskilled laborer of today and not many of them are paid better than a skilled manual workman; they forego the making of money for the love of science; they are scholars and gentlemen drawn to their work with fine enthusiasm, for the sake of which they are willing to live simply, even precariously. They deserve to be treated properly. If they are both under-paid and badly housed, they will be compelled to go elsewhere. This is not a time for trying the patience of the scientific worker and educator; he is peculiarly the victim of the high cost of living; if the Government is so foolish as to deny him a chance to do his work well—the professional ideal—it will lose his services. During the last decade the Survey has lost several of its best men; it has failed to hold them because of the greater attractions offered elsewhere—attractions not wholly pecuniary; it would be a great blunder to blunt the loyalty and dull the enthusiasm of those that remain by housing them uncomfortably and trespassing upon their self-respect. The mining industry as a whole, we feel sure, will join in protesting in their behalf against the step that the authorities at Washington propose to take.

IN the article by Mr. A. H. Heller in our issue of August 2 on the operation of the Horwood process at the Afterthought mine, the horse-power used by each Marcy mill was stated to be 125. Mr. Heller asks us to make a correction. The nominal horse-power for each mill is 100, but the actual running horse-power is only 68.

Arrival of the Fleet

On May 6, 1908, the people of San Francisco stood on their seven hills and waved a welcome to the fleet under Admiral Evans then on its way around the world. Yesterday they welcomed the mightier armada of the Pacific Fleet, under Admiral Rodman, as in single column ten miles long it entered the Golden Gate to make its home on this coast. History repeats itself; eleven years ago as yesterday the fog threatened to mar the glory of the day, but it shifted just before the long line of battleships entered the bay, and when the flagship passed Alcatraz island toward the inner harbor the sunlight broke through the rising mist and quickened the gray hulls into living beauty. The blue sky of California canopied the scene ere the leviathans of war had come to anchor, as on the former occasion, but the tide on whose flood they entered served to symbolize the flow of human events in which the American navy had but lately played a splendid part. In 1908 we looked on the fleet and thought of the Spanish war; yesterday the 'Oregon' revived those memories, as the Secretary of the Navy, with the Governors of California and Nevada, stood on her deck to receive the salute of the entering warships. Then we thought of war; today we think of peace. The fleet by its service overseas had brought the War to an end and we looked upon it as insurance against war in the future. In 1908 Admiral Evans and his 18 ships came around the Horn; this time Admiral Rodman and his 51 ships came through the Panama Canal, and at our feet lay sundry remnants of the 1915 Exposition, which had celebrated the completion of the isthmian waterway. Yesterday the drone of engines in mid-air made us glance skyward, as aeroplanes flew overhead and their pilots took photographs of the arriving squadrons. In 1908 man's mastery of the air was not anticipated, although in the following year Bleriot, by crossing the English Channel, proved that another dream had come true. Eleven years ago the coming of the fleet served also to celebrate the rise of San Francisco from the ruins of the earthquake-fire that two years before had brought death and devastation to this community. We thought then that imagination could not conjure a worse horror than that calamity; yesterday we celebrated the ending of a greater calamity and hoped intensely that the conflagration of war and the earthquake of social disruption might be spared to us and our children in the years to come.

Engineering Unity

The president of the American Association of Engineers, Mr. F. H. Newell, is signalizing his year of office by visiting the principal centres of engineering activity, all the way across the continent, from Boston to San Francisco. During his short stay in our city he gave an address before the Engineers Club and had no difficulty in holding the close attention of a thoroughly representative gathering of the profession while he explained the origin and aims of the Association. It started early in 1914 as an organization of the engineers employed by the City of Chicago, and it had barely made a start when it was rent in twain by a difference of opinion as to the desirability of affiliating with the labor-unions. The half that did take the extreme step was duly absorbed and lost its identity, whereas the other half proceeded to work out its own salvation, incorporating under the laws of Illinois as the American Association of Engineers. From the first Mr. Newell gave it his sincere support. As former chief of the U. S. Reclamation Service he had a large acquaintance in the profession and with his gift of leadership he was able to rally a considerable number of recruits, in which he was aided notably by Mr. W. H. Finley, formerly chief engineer and now president of the Chicago & Northwestern Railroad, who was his predecessor in the presidency of the Association and attracted many of the younger railroad engineers to it. Mr. Newell spoke feelingly of the late Arthur Kneisel, first president of the Association, "who literally gave his life to the cause of engineering unity and brotherhood," for, by his exertions, he overtaxed his strength fatally. Enrollment at the present time, we are told, is at the rate of 1000 new members per month, a fact that in itself commands attention. Mr. Newell asserted that there existed "a ground-swell movement" among the younger engineers, who were gaining a larger pride in their profession and a keener vision of its duties to the community; also of the community's debt to them. One of the first moves made by the Association was to wait upon the Railroad Administration, and ask for an increase in the salaries paid to the civil, mechanical, and electrical engineers, who up to that time had been paid at the same rates as obtained fifty years ago, when the purchasing power of the dollar was three times greater. Since then the Association has sent its representatives to interview State bureaus, municipal councils, and other employers of engineers, and has succeeded in obtaining raises of salaries. Indeed, this feature of its program—the bread and butter feature—differentiated the Association from the ordinary technical societies from the very start. Next it is undertaking to help engineers to obtain employment, and has established a bureau for this purpose. Moreover, at its various meetings the subjects discussed are not the purely technical phases of engineering, but such as are related to the life of the engineer himself and his activities as a member of the community in which he lives. The old idea that the term 'engineer' is synonymous with 'engine-driver' is pretty well exploded, for the modern world recognizes that the engineer is "a man of ingenuity", as Mr. Newell said. He is "the most useful man in the community" and it is ludicrous to see how even in these days he is overlooked when appointments are made for public offices requiring a knowledge of engineering; for example, when the mayor of Chicago had to appoint a smoke inspector, he selected a dentist! Mr. Newell made it clear that the organization of which he is president has for its purpose

the strengthening of the engineer's status in society and an increase of the engineer's participation in public affairs as a man and a citizen peculiarly fitted to give valuable service to the State. We are glad that he corrected the prevailing idea that the Association was drifting toward labor-unionism; instead the Association aims to preserve the independence of the profession. He and his friends have plenty of genuine enthusiasm for their cause and they are accomplishing results not to be ignored by the older technical societies.

War Minerals Relief Scandal

Those who read our editorial of August 16 on this subject should read the letter from Mr. J. E. Spurr on page 323 of this issue. He makes it clear that he himself favored equitable interpretation of the Relief Act and that it was not his fault if the Attorney-General interpreted the intent of it otherwise. Mr. Spurr suggests that our criticism indicated some sort of notion that the Attorney-General had "authority to modify legislation". We are perfectly well aware that he has no such authority, and our remarks do not justify any such inference. We do believe, however, that as the administration of the Act was placed in the hands of the Secretary of the Interior, he could have given more generous interpretation, such as Mr. Spurr advocated, without incurring criticism. If the language of the Act "could hardly be more clear", why did he have to ask the Attorney-General to interpret it? We note Mr. Spurr's tribute to the work of Mr. Burch and his assistants; it is well merited. We have not the least doubt that Mr. Spurr's prolongation of his own war-time connection with the Government was prompted by patriotic reasons, for we know that he gave his services unreservedly to the Nation during the War and that those services proved of great value in several directions. It would be entirely unnecessary for us to mention this phase of the matter if he had not, in his letter, referred to it himself. Mr. Spurr's further remarks about the "request or demand" on which the miners acted are interesting, but his attitude toward Mr. Toll is not in harmony with them. He dismissed that engineer because he gave a letter that assisted a claimant in obtaining compensation. That is the reason given in the telegram of dismissal. In a confirmatory letter he says that he is well satisfied with Mr. Toll's reports, "but it is necessary in this work to have an examiner without bias, one way or the other, and these letters and affidavits which you have made to help out claimants evidently take you away from the judicial position." We see nothing in Mr. Toll's statements, as given to various claimants, to justify the charge of bias; he simply put in writing what he had been authorized to state at the time when, as an assistant of Mr. Burch, he had taken part in the official campaign for stimulating the production of war minerals. Mr. Spurr says that he was "advised by the Commission" that Mr. Toll received payment for "reports, letters, and affidavits for claimants". This is not true; Mr. Toll did examine mines and did make reports while out of the Government service, but not while he was in it, nor did he at any time ask or accept payment for confirming by writing the verbal statements he had made to the miners during the period when he was authorized to make such statements. Mr. Toll was out of the Government service between September 15 and June 2. Is it suggested that he should have abstained from practice as a mining engineer during this interval on the mere chance of re-employment by the Government, or is it suggested that the reports he made on mines for private clients would be more optimistic than those he might make for the Government? Such a suggestion is an insult to the profession and an impertinence to Mr. Toll, whose record gives no excuse for it. As to whether he over-stated the facts in his letter to Mr. Payne, we quoted Mr. Spurr's telegrams to the same effect and the one sent by Mr. Sanford to the President of the San Francisco Chamber of Commerce. Whether Mr. Spurr's telegrams were dated before or after Mr. Toll's statement to Mr. Payne does not matter, for they indicate the probability that Mr. Toll was only saying what he believed himself justified in saying on the authority of Mr. Burch and other Government officials. He had no written instructions to this effect, we understand, but he was told to advise the miners not to start any large work the cost of which could not be redeemed within a year, and this warranted the inference that the market would be maintained by the Government for one year at least. Shortly afterward, on August 8, the War Board stated that the Californian production of chrome must be maintained and that the Board itself was "ready to take whatever steps are necessary". A month later an assurance was given that the market would be maintained for the first half of 1919. We quoted the telegrams, in which these assurances were given to the mining public, in our issue of August 16. Whether Mr. Toll "over-stated the facts", as Mr. Spurr asserts, we leave the reader to decide for himself. We took up the cudgels for Mr. Toll because we believe that the 'Mining and Scientific Press' can perform no better service than to defend a member of the profession when he is unjustly treated either by an official or by a corporation. We believe that the treatment meted to Mr. Toll is unjust to him and derogatory to the mining profession. As to the personal touches in Mr. Spurr's letter, in so far as they are aimed at the Editor, we waive the opportunity to retort in kind. When he has been an editor himself he will learn that criticisms must be made as a matter of public policy even at the risk of imputations of various kinds. We have no quarrel with Mr. Spurr personally, and that is why, in our editorial of August 16, having once mentioned him by name, we referred to him repeatedly as the 'Chief Engineer' for investigative work under the Act. We were criticizing an official, not Mr. Spurr as an individual. We did not ask him for an explanation, because the whole case at issue was stated in the telegram of dismissal sent to Mr. Toll. To have asked Mr. Spurr privately for further explanation would only have aggravated the controversy.

Blast-Furnace v. Reverberatory in Copper Smelting

The Editor:

Sir—Referring to the article by O. E. Jager in your issue of June 21 and the letter from Walter G. Perkins in your issue of July 19, under the heading of 'Exit the Blast-Furnace', I beg to say that the blast-furnace has made its exit and re-entrance several times in the history of copper smelting in this country. Having been interested in the development of both the blast-furnace and the reverberatory, I think I can speak impartially.

There is no doubt but that at the moment, in favored localities where pulverized coal or fuel-oil can be obtained at a much cheaper rate than coke, the reverberatory has the better of the argument, but there is always something turning up in favor of the other side in every controversy. It resembles the perpetual fight between armament and projectiles that we are all much more familiar with at present than we were prior to 1914.

The latest improvement in blast-furnace practice is the introduction of pulverized coal at the tuyeres, the notable examples of this being the Tennessee Copper Co. smelter and the International Nickel Co.'s plant at Copper Cliff, Ontario. If the experiments now being tried at various plants, besides the two mentioned, prove that pulverized coal can be used economically in the blast-furnace, either with or without a proportion of coke, the probabilities being that a certain proportion of coke will be necessary, the existing interest in blast-furnace practice will receive an impetus.

At one plant where the reverberatory was for a time dominant, it has had to take a back seat recently, namely, that of Copper Cliff, where the tendency is to return to blast-furnace practice. Also please note that when the reverberatory smelter-man runs across a refractory charge, he immediately puts his blast on the job, if he has one, and if he hasn't, he tries to dispose of the refractory material to some more fortunate metallurgist who is provided with the necessary blast-furnace.

There is no talk of the Tennessee Copper Co. giving up its blast-furnaces.

The new plant being erected in Chile for the Braden Copper Co. contemplates the use of the blast-furnaces entirely, using nodulizing-furnaces to prepare the charge. Today it is about a stand-off in cost between nodulizing or sintering for blast-furnace practice and roasting for reverberatory practice.

The essentials for successful reverberatory practice today are much as they have been in the past, namely, self-fluxing ores, cheap fuel, and cheap silica-brick; whereas for blast-furnace practice the charge may be more refractory, but must be either sintered or nodulized or come naturally in lumps, and in addition the fuel and power must be comparatively cheap.

The exit of the blast-furnace is not yet in sight, at least the door has not opened widely. Both styles of furnaces have their field, but for the moment, owing to the great increase in tonnage treated by oil-flotation and the improvements in reverberatory practice, the reverberatory seems to be gaining materially in tonnage treated.

E. P. Mathewson.

New York, August 13.

The War Minerals Relief Scandal

The Editor:

Sir—I note your editorial on this subject in your issue of August 16, and it apparently calls for a reply. I will not attempt to follow the sinuosities of your article, but will go straight to the point and give certain information which you could have had before if you had wanted it.

(1) It may interest you to know that on May 9, 1919, I submitted to the proper authorities a plan to interpret the provision which Congress had inserted in the War Minerals Relief Act (limiting the possibility of compensation to those who had produced certain minerals "in compliance with the request or demand" of certain Departments and War Boards), by assuming that the *general Government campaign of stimulation* could be interpreted as such a request or demand. There follow extracts from my presentation, which was a long one and contains much that is not germane to the point I wish to make:

"The proper application of the Act and the correct interpretation of the phrase above quoted can only be made through a close knowledge of the history of the situation which led miners to feel that the Government had enlisted assistance in a program of which the Government itself failed to carry out its part, and led Congress to see the justice of their complaint and to provide for compensation at the Secretary's discretion."

"The activity of the Government which gave rise to the situation on which the claims of the miners for compensation were based, was that of the Shipping Board and the War Trade Board which, in accordance with the Executive Order of the President to secure ships for

military purposes by cutting down imports, formulated and put into effect a program for the restriction of imports of pyrites, chromite and manganese, and called on the country in unmistakable and vigorous terms to produce enough to make good the deficiency, as an act of patriotism."

"The general active stimulation and vigorous encouragement which amounted practically to a general 'request or demand' by the Government concerning these minerals warrants, in my opinion, a general plan of compensation for the losses entailed in mining these minerals as a consequence of this governmental campaign of stimulation; and is a far stronger justification for compensation by the Government than the representations or informal advice, opinion, or encouragement of any minor official or officials of the Government."

(2) You must know, however, that in the United States the only body or individual authorized to dip its hand into the public Treasury is Congress. The question was, therefore, not what I or you, the Commission or the Secretary, would like to pay out of the Treasury, but what Congress had authorized to be paid out; our personal opinions do not warrant our tapping the public funds, whether for our own enrichment or that of our friends, or of attempting to do so; and fortunately for the public, there would be little guarantee of personal safety to anyone thus attempting to carry out his convictions. The matter was finally referred to the Attorney-General, as the official interpreter of legislative language, and he rendered on July 1, 1919, a decision, in which he clearly showed from the language of the Act and its history, the intent and authority of Congress. He stated, "The language used could hardly be more clear or allow less room for construction. No claim based upon a general solicitation or appeal is recognized by it, but to come under the statute the claimant must have been asked specifically by either the Department of the Interior, the War Industries Board, the War Trade Board, the Shipping Board, or the Emergency Fleet Corporation to produce or prepare to produce one or more of the four named minerals."

Even the Attorney-General, you must know, has no authority to modify legislation. Your editorial would indicate that you thought he had.

(3) The work done by Mr. Burch and his assistants in stimulating the production of chromite and other war minerals on the Pacific Coast was of the most effective and valuable character and their patriotic services have always been fully appreciated by their colleagues in Washington. The stimulation was of the most vigorous kind which circumstances and their authority permitted; not only individuals were exhorted, but addresses were made by the engineers at public gatherings in mining districts. (Entirely similar activity, it may be noted, was carried on by Government engineers and geologists in the East.) It was on account of this most valuable work and their familiarity with the field that on the organization of the War Minerals Relief field examinations as many of the old staff as could be secured were re-engaged. Only Messrs. Shonts (in Oregon) and Messrs. Cameron and Toll (in California) could be secured.

(4) All decisions relative to War Minerals Relief are in the hands of the Commission. On request, I undertook (dare I say, for patriotic reasons?) to prolong my war-time connection with the Government long enough to organize the investigative force, but no longer. The function of this force is to provide the Commission with such facts as they may request, whereon to base their decisions. Therefore, I do not know what their attitude may be on any question, but personally (not officially) I have always felt that the case of the Pacific Coast chrome miners was one of the strongest which they will have to consider on this very point of "request or demand", and precisely on account of the requests presented by our field engineers. And in the case of each claim which comes up for examination (this applies to the whole United States) the field engineer or other government official who is named by the claimant as having made upon him a request or demand for production, is immediately interrogated by special letter as to the facts, and such testimony is very influential in determining the order of examinations. In the case of large numbers of claims we have the written testimony of engineers, nearly all of them now on our staff or on that of the Geological Survey, that they made such request or demand, and in my personal opinion, these represent a very strong class of claims for the Commission to consider.

(5) The claim of L. R. Payne & Co., No. 480, was judged on the basis of Mr. Toll's testimony to belong in the above class, and a field examination was ordered July 18, 1919, by Harry Sheafe, engineer (employed on recommendation of Mr. Burch) and E. L. Fleming, auditor.

(6) What, then, was the basis for discontinuing Mr. Toll's services as field examiner, of which he and you make a national issue?

You state that he was dismissed "for telling the truth". Judged on the basis of this statement alone, you would have been in little danger of dismissal had you been in Mr. Toll's place.

In the interval between his engagements as government engineer he made reports and affidavits for various claimants, whose mines he had examined while in the Government's employ, in order to assist them in collecting from the Government. But I find no valid reason for criticizing him for this. The reasons why his attitude might be considered by some as having become slightly unjudicial were:

(*a*) He made these reports, letters, and affidavits for the claimants for a monetary consideration, as I was advised by the Commission when in San Francisco.

(*b*) In his letter written for the Payne company to exhibit he overstated the facts. He stated that he gave claimant certain sweeping Government guarantees on June 7, 1918. When his authority for this was challenged he cited, first a letter written by me to another party on September 30, 1918, second a clipping from

the San Francisco 'Examiner' of October 1, 1918, and third a telegram from myself to Mr. Burch dated August 8 or 9, 1918. In my reply to Mr. Toll I summed up as follows:

"All of this would seem to indicate to me that you derived your impression from the above letter and telegram, but at a subsequent time from that which you assign in your letter of July 23 to me and refer to in your letter of March 12, 1919, to the L. R. Payne Co., and that accordingly your letter to the L. R. Payne Co. was an error of recollection. This would indicate a zeal in supporting the claimant which is hardly judicial."

It was felt that, to be above criticism, any question as to the judicial attitude of any examiner should be settled by relieving him of further responsibilities. Examiners must be prejudiced neither for nor against claimants. All appointments are temporary as is (let us hope) the character of our work. No onus was involved, and it is too bad that Mr. Toll decided to rush into publicity and that you were hasty enough to take it up. Several other members have had their terms of employment terminated, but so far have not appealed to the President to be put on the payroll again.

Having given you a deal of information, I should like to have some myself:

1. What is your motive in rushing into a personal attack, without trying or apparently wanting to ascertain the facts? Many months ago, touched by your editorial efforts to comment intelligently on what was going on in Washington, I wrote you, offering to write or telegraph information whenever you wished it. You have never called for any.

2. This is a psychological problem. Why is it that an editor who hates the daily yellow press as laudably as you do, should himself tend so strongly in the direction of technical yellow journalism?

I shall be glad if you will publish this letter in full.

Washington, August 20. J. E. SPURR.

[We refer to this letter on another page.—EDITOR.]

The Editor:

Sir—I have just read with a great deal of interest your article on this subject appearing in the issue of August 16.

In reference to Mr. Spurr's action in recalling Mr. Toll from his service as engineer for the Commission there is every reason to believe that Mr. Spurr has shown his hand to be out against a fair and impartial administration of the Minerals Relief Act.

I wish to support the evidence offered in your article, and state that on October 14, 1918, I personally interviewed George Otis Smith, Director of the U. S. Geological Survey, J. S. Diller, Chief Geologist, C. K. Leith of the Shipping Board, and Hugh W. Sanford, of the Ferro-Alloys Section of the War Industries Board. On this date these gentlemen gave me assurance of immediate Government action being taken for the protection of the domestic chrome producer by providing a market for chrome ore at fair prices and approximately the same as prevailed during the summer 1918. Mr. Sanford went further and stated that he had already asked the consumers to purchase 5000 tons of chrome ore, which was temporarily to relieve the situation pending definite Government action for protection of domestic production. I left Washington that evening en route west fully convinced that all chrome ore produced domestically of 40% chromic oxide content, or over, could be readily marketed during the balance of the year and during the first half of 1919. What developed later is well known.

I was present at Medford, Oregon, when many of the claimants were questioned by the Commission. In the light of the opinion of Attorney-General Palmer in respect to the words 'request' and 'demand' as embodied in the War Minerals Relief Act, at least 50% of the claimants for reimbursement on chrome activities will be eliminated from consideration by the Commission. This interpretation, even to the casual reader, must appear absurd. The idea that because a claimant received no "specific" request or demand from one of the five Boards or Departments of the Government, but did receive a general request, would be cause for not being considered worthy of reimbursement under this Act, brings us to wonder if we live in the United States or Mexico. Mr. Palmer, according to his opinion, evidently considers all bulletins and circulars issued by these five Boards or Departments non-consequential so far as being worthy of notice to the extent of conforming thereto, inasmuch as if a demand is printed in a circular form and the same demand embodied in a letter, one carries responsibility under this Act and the other does not. These mental gymnastics are not understood by the Western miner but come as a surprise, and such practices are not creditable to any Administration.

The Commission showed a desire to treat fairly with all claimants except for asking numerous questions that could have no bearing on the merits or demerits of the claims, but sort of embarrassed some claimants by the personal attacks on patriotic and judicial lines in the opinion of the claimant. But if the Commissioners are to be limited in making awards to such narrow confines as the interpretations expressed by Mr. Palmer in his written opinion to Secretary Lane, the claimants in general will fare slim.

We wonder if Mr. Palmer, like Henry Ford, had someone do this for him.

GEO. S. BARTON.

Grants Pass, Oregon, August 18.

The Crowe Process

The Editor:

Sir—I have read with interest the letter by N. S. Keith in your issue of August 23 and your editorial comment thereon. It is true that it has long been recognized, at least on *a priori* grounds, that the less opportunity for absorption of atmospheric oxygen afforded to a solution during precipitation the better it would be for the success of that operation, and in addition to the instance quoted

by Dr. Keith of Swinburne's comment during the discussion in London in 1895, it may be noted that attention was directed to the same point in the original patent specification of the Merrill zinc-dust precipitation. In spite, however, of this common recognition of the general principle involved it does not seem to have occurred to any one of us to make a practical application of it until Mr. Crowe led the way.

It is interesting to note that in connection with the recently devised method for determination of oxygen in working cyanide solutions developed by H. A. White and described in the Journal of the Chemical, Mining and Metallurgical Society of South Africa for April 1918, attention has been called to the oxygen content of the solution in different compartments of the zinc-boxes and in various parts of the plant, and that during the discussion of the data obtained by this method of determination suggestions were offered as to the feasibility of forcibly abstracting the dissolved air from the solutions before precipitation. This discussion took place, or was at least well advanced, before those taking part in it were aware that a patent for doing that very thing had already been obtained by Mr. Crowe.

Dr. Keith suggests that the Crowe process has been (1) anticipated, and (2) consciously anticipated, in the various forms of vacuum filtration that have been in use during the last ten or fifteen years. But I think it probable that neither of these assumptions is correct.

1. It is questionable whether any appreciable amount of dissolved oxygen is removed by subjecting solution in bulk with a small surficial area to the influence of reduced pressure, at least during the few minutes occupied in its passage from the filter-medium to the storage-tank. But, even assuming that sufficient de-aeration takes place in the receiver of a vacuum-slime filter to have an appreciable effect on precipitation, this result would in practice be nullified by the fact that such solution instead of passing directly to precipitation through an air-tight pipeline goes to a storage-sump and from there usually to a clarifying filter before reaching the precipitation system. Now, the researches on the Rand already mentioned go to show that the re-absorption of oxygen by a de-aerated solution is so rapid that while a sample from the last zinc-compartment contained practically no dissolved oxygen, yet one taken from the barren sump showed an oxygen content approaching the saturation point. It would thus seem that no amount of de-aeration during vacuum filtration (assuming such to take place) would have any effect on precipitation.

2. In support of the thesis that de-aeration during vacuum filtration was consciously practised with a view to its effect on precipitation before the date of the Crowe patent, Dr. Keith relies on various quotations from technical writers. In the absence of direct information from the authors of those papers as to the thought present in their minds at the time of writing and the meaning they themselves attach to the quotations given, I think a fair interpretation would limit it to the air-bubbles mechanically entrained in the solution as it flows from the filter-leaves to the receiver, since anyone who has worked with vacuum-filters knows that during a large part of the cycle the effluent from the leaves is rather in the nature of an emulsion of air and water, on account of leakages in the attachments of the filter-medium to its support and on account of the fact that, at least in filters operating on the cycle principle, the cake is wholly or partly exposed to the air at certain periods. In the case of the Oliver filter also, the leakage of compressed air from the blowing-segment to the vacuum-segments causes a considerable quantity of air to pass continually into the vacuum-receiver with the solution. This interpretation is corroborated by the use of the phrase "entrained air" in the quotation given from the paper by Charles A. Chase and by the fact that in no case does any of the writers give a hint that he supposed he was extracting *dissolved* oxygen from his solution. The use of a dry-vacuum pump to take care of the entrained air while the solution is removed from the drum by means of a gravity-drain or a wet-vacuum pump was the original method used on the first Butters filter ever constructed, but I know from personal association with the development of that filter that the idea of removal of dissolved oxygen from the solution by such an arrangement never entered the head of any one concerned.

Dr. Keith's quotations from Julian and Smart do not appear to me to have any bearing on the question. The first, that on page 35, merely describes a method of aerating a laboratory charge of sand prior to the application of the cyanide solution, and the apparatus illustrated is for measuring the cubic feet of air so drawn through the charge. The second reference (pages 56 and 57) applies to the well-known use of a vacuum beneath a charge of sand to hasten percolation or to remove surplus moisture, and comes under the same classification as the vacuum-slime filters with their incidental separation of entrained or emulsified air from the solution, as already explained, although I find no mention of such separation in the pages quoted, the only reference being to the removal of films of air around particles of sand in order to allow the solution to come in contact with them.

It seems to me therefore that Dr. Keith has not produced a single instance of the practical application of a vacuum that either resulted in or was designed to result in a removal of dissolved oxygen from cyanide solution as a preliminary to precipitation.

E. M. HAMILTON.

San Francisco, August 25.

THE IRON ORE mined in the United States in 1918, exclusive of that containing 5% or more of manganese, amounted to 69,658,278 gross tons, compared with 75,288,851 tons in 1917, a decrease of 7.5%. The quantity of ore shipped from the mines in 1918 was 72,021,202 gross tons, valued at $244,368,147, compared with 75,573,207 tons, valued at $238,260,444, in 1917, a decrease in quantity of 4.7%, but an increase in value of 2.6%. The average selling value of the ore per gross ton at the mines for the whole United States in 1918 was $3.39, compared with $3.17 in 1917. The stocks of iron ore at the mines, mainly in Michigan and Minnesota, amounted at the close of 1918 to 8,471,507 gross tons.

Ore-Buying in Chile

By C. A. GRABILL

Visitors to the West Coast of South America and especially to Chile are frequently puzzled by the constant reference to "Jackson base" or "Jackson price" in all dealings covering the sale of copper ores and products.

On account of its age, one may almost say antiquity, and its isolation, the copper industry in Chile has developed along lines radically different from those of our own country and one of the peculiar developments is the method of purchase and sale of copper-bearing materials. This is interesting to those engaged in the business, primarily from the fact of its importance in the industry today and secondarily on account of its influence, which has been good in some ways and bad in others, on the mining industry.

Except the production of the Chile and Braden copper companies, most of the ores of the country are sold on the basis of the Jackson price. This price is issued biweekly by the firm of Jackson Hermanos at Valparaiso and is quoted for three products, bar copper equivalent to London standard, copper matte containing 50% copper, and copper ore containing 10% copper, together with a factor or scale covering variations from the base assay. At the same time they publish the official quotations for London standard, three months, the exchange rate between *moneda corriente* of Chile and English pence, and also the freight from Valparaiso to England. The price is quoted per 100 kilogrammes (one metric quintal), and no account is taken of the composition of the ore other than its copper contents, nor of the gold and silver contained therein; and there is no deduction for treatment, this being taken care of in fixing the price.

At first sight this seems to the average American, accustomed to the elaborate analytical methods of our own smelters, as a rather careless arrangement and not at all satisfactory; it is assumed that the almost universal acceptance of the system must be due to ignorance among a people unfamiliar with the business. A little more knowledge soon dissipates any such idea. Chile was a copper-producing country even before the coming of the Spaniards or the landing of the Pilgrims, and has been a pretty constant producer ever since. Copper ore was mined and smelted and the product shipped for the manufacture of cannon some three hundred years ago, so it may be fairly assumed that the people know what they are about and that the general acceptance of any system is probably due to some inherent advantage or especial adaptation to conditions that make it superior to others.

As a matter of fact, the Jackson price is especially adapted to the conditions that have prevailed, and it has several advantages. The majority of the copper deposits so far worked consist of small and narrow veins of little depth, but numerous and widely scattered. There are therefore a large number of prospectors, small miners, and lessees who make a living producing from a few hundred pounds to a hundred tons per month. The individual amounts are extremely small, but the totals run into figures that are quite important in the copper production of the country. The custom is that the ore-buying agencies and smelters scattered throughout the country put up a notice on the issue of the Jackson price that they are paying the price for ores delivered to them with such and such discount depending on the locality and the local conditions. The small producer is thus assured of a steady market for his product from a sackful up, the price varying only with the copper contents and the exchange. This last factor until the War has not been of serious importance owing to the fact that the prices of supplies varied with the exchange exactly the same way as did the price of the ore, and so while it seriously affected those industries in which the labor item was a large factor it did little harm to the man who sold directly the product of his own labor.

Two other factors of importance are that as the grade of the ore decreases, so does the proportion of the intrinsic value of the ore recoverable by the buyer, and consequently his profits; and as the price of copper in London decreases, so does the buyer's profit. This makes a kind of flywheel of the buyer, it being understood that the term 'buyer' includes the smelter, who thus carries the small shipper through the periods of low copper and hard times, presumably making proportionately higher profits when copper is high and times good. A fourth factor of importance is that the price is so regulated that it protects the smelter from loss caused by high freights and exorbitant charges for fuel.

In order to see how this is brought about it is necessary to examine the method by which this price is obtained. It is based on the honesty and good faith of Jackson Hermanos, who, as previously stated, issue it every two weeks; and its almost universal acceptance speaks highly for their reputation. They never have published the formula by which it is arrived at, so most copper men on the West Coast have in their notebooks "the exact method for calculating the Jackson price which was given to me by a man who knew all about it." As a matter of fact, these all differ among themselves, and the true formula has itself varied from time to time, even the quantities used being subject to a certain latitude of judgment.

One formula, which is not correct yet will give prices very close to the published ones under widely varying

conditions, and which bears a fair resemblance to the true one, is as follows:

Let x = Jackson price for bar copper
a = Price of London standard, three months, in pounds sterling
b = Cost of refining standard copper
c = Commission and insurance, per cent
d = Freight from Valparaiso to England
e = Cost of one ton of coke, Chile ports
f = Exchange, that is, value of one peso *moneda corriente* in pence
1.0156 = the ratio between a long ton and a metric ton.

London standard is always quoted, of course, in sterling per long ton and the Jackson price is in *moneda corriente* per metric quintal of 100 kilogrammes. In this connection it should be noticed that Chile is cursed with a double currency; a nominal gold currency one peso of which is nominally worth 18 pence, but which in the fall of 1917, owing to war conditions, was being quoted around 23 pence, and an unsecured paper currency having the same nominal value, but fluctuating widely and at present quoted around 14½ pence. In accordance with the economic law governing such matters the gold currency has practically disappeared in the ordinary commercial transactions, although frequent reference is made to it.

Using the above signs the formula is

$$x = \frac{0.1}{1.0156}(a - b - d - e)\frac{(100 - c)}{100}\frac{(240)}{f}$$

*This gives the price of one quintal of bar copper. The price of one quintal of 50% copper matte is found by deducting 18 shillings, or its equivalent, and dividing by two. The price of one quintal of 10% copper ore is found by taking 53% of the price of bar copper and dividing by 10, it being considered that 47% of the intrinsic, or net, value of the copper in 10% ore, after deducting shipping and refining costs, is the proper proportion due the smelter for operating expense and profit.

The factor or scale (*escala*) for the variation in assay of the ore is obtained by taking one-tenth the price (base) and adding 10 centavos (for ore, not matte).

To make the matter clearer we will take two concrete examples, one using the figures for 1910, four years before the War, and the other those of August 1917.

The average price of London standard copper, three months, for 1910 was £57.19.1 and the average value of one peso, Chile paper, was 10 57/64 pence, refining £1 10s., freight from Valparaiso to England 18s., one ton of coke cost 35s. and interest, commission, and insurance 1½%. Substituting these values in the above formula and solving we obtain $115.00 m/c (moneda corriente) as the value of one quintal of bar copper compared with the average published Jackson quotation of $115.77. Then 5.3% of this gives us $6.14 m/c as the value of one quintal of 10% ore and 1/10 of that plus 10 centavos is 71.4 centavos, according to the scale, that is, a 9% ore would be worth $5.426 and an 11% ore $6.854 m/c.

These prices are supposed to be on board ship, and a deduction of 25 centavos per quintal is made for Jackson on land (*a tierra*), the loading expense being assumed at $2.50 per ton m/c.

In August 1917 the price of London standard was £119 10s., freight was 200s. instead of 18, and coke was 160s. instead of 35. Exchange was 13¼. Substituting these figures, we find that the price of 10% ore was $9.12¼ and the scale $1.01¼; thus we see that, although the price of copper in the world's markets had more than doubled, the Jackson price had not increased 50%, the difference being due to the difference in exchange and freight and fuel.

It is, of course, clear that this price is not fixed by any law of nature or State; it is entirely dependent on the good faith and judgment of the firm issuing it; nevertheless it is generally used in Chile by all ore-buyers and smelters either as published or with slight modifications in the base or scale as required by local conditions. In recent years it has unquestionably had great influence on the development of the mining and smelting industries.

Referring to the formula, and omitting consideration of the prices for bar copper and matte, we find that after deducting the direct charges for refining and marketing the remainder of the value of a 10% ore was divided between the miner and smelter in the ratio of 53:47, both parties paying their operating expense and obtaining their profit from their respective proportions. The smelter is partly protected from excessive freight-rates and fuel-costs by the arbitrary deduction of the price of one ton of coke before the division. The price also varies inversely as the exchange-rate; and this is quite proper, for if the paper money loses half its value the seller receives twice as much of it; and as its purchasing power has also dropped, the miner is in the same position as before. It should be noted that it is the exchange on London that governs.

If copper rises in price at London the miner receives only 53% of such increase in value, but, conversely, if it drops the buyer has to carry 47% of the drop and his profits begin to disappear accordingly. The idea underlying this was undoubtedly that the smelter and the miner would both cease to make profits at the same time and to hold the price as steady for the miner as possible, the smelters making their profits in prosperous times and on high-grade ores. The latter result was assured by the scale. If it is assumed that a 10% ore represents average conditions as to cost and profit, then the profit on a 15% ore must be considerably greater, as the smelter still receives a large proportion of the increased value without greatly increased expense. On the other hand, on the lower-grade ores his profit falls off very rapidly, as he still receives only 47% of the value and his expenses have increased rather than decreased. This is somewhat but inadequately compensated by the increase of 10 centavos in the scale, and so the buyer protects himself

*A, b, d, and e should be stated in pounds and decimals thereof or, as an alternative, they may be stated in pence and the constant 240 struck out.

by making a flat ruling that he will purchase no ores containing less than a fixed minimum, say, 6% copper.

The result has been satisfactory to the small shipper and prospector, as they know that any ore above this limit will bring a certain definite amount; therefore the prospector goes out into the hills, finds a small stringer from which he can gouge out a few hundred pounds of ore, does so, takes it to the nearest ore-buyer and sells it on a cyanide assay of a grab-sample without regard to the content in silica, iron, or lime, or even gold or silver, unless there is a great deal of it, and so there has been an enormous amount of prospecting for high-grade surface deposits. The expense of handling these small amounts must necessarily be borne by the average price and there is little incentive to sorting and concentrating other than that caused by freight charges. Inasmuch as the ores are mainly silicious, expenses high, and fluxes scarce or unobtainable, I am inclined to think that this method of ore-buying is partly responsible for the large number of abandoned smelters throughout the country.

To take a specific example. Assume a mining district in the interior with high freight-rates to market. 'A' is the owner of a typical deposit. He can produce monthly a few hundred tons of silicious ore of about 7% copper, but on account of the cost of shipping he is compelled to sort it up to 10%, which gives a neutral product suitable for smelting. He has a low-grade dump, naturally very silicious and containing only 3% copper. 'B' looks over the district as a possible smelter-site. He finds that there is not enough 10% ore to warrant a smelter, but there is considerable 7% ore not being shipped as it will not pay. However, 7% ore will pay expenses and keep the smelter running, and the profit on the 10% ore will make a good return on the investment. He offers to pay the Jackson price, and makes the lower limit 6½%, because it will pay operating charges and carry a little of the overhead expense. Fluxes are scarce and expensive, but little are required, because the 10% ore, which constitutes the bulk of the production, is a neutral ore. He commences operations. 'A' immediately sees that 3% ore on the Jackson price is worth $2.30 per quintal and the cost of delivery to the smelter close-by is only $2 per ton, or 20c. per quintal. Of course, it is below the minimum, so he mixes one ton of 10% with one ton of 3%, obtaining two tons of 6½%, which he ships. 'B' no longer has any 10% on which to make profits and has the choice of raising his minimum or cutting his price. Whichever he does it cuts down his tonnage, and compels him to smelt a certain amount of low-grade silicious material at an excessive cost, which must be borne by the better material; nor is there any satisfactory method of avoiding it except by a tariff based on the composition of the ore.

If, in the case referred to, a penalty be applied to the silica contents it might prove possible for 'A' to so sort his ore as to make a basic product worth more to the smelter than the combined materials he is shipping and the smelter would be enabled to lower its minimum to 5% or less and still make money.

Another objection to the Jackson price is its failure to take any consideration of the gold and silver. Chile has been a great producer of these metals, but at the present time there is not any adequate encouragement to the prospector to look for copper ores containing gold and silver or for silver ores suitable for smelting. It is quite possible to formulate a method of payment that will cover these points, but it is then no longer the Jackson price.

This condition of affairs is being recognized and smelters are introducing silica penalties, premiums for iron and sulphur, etc., but the result is still only a compromise. Ultimately the country will come to our own methods, paying for the metals at their recoverable value, with a treatment charge in accordance with the analysis and proportionate to the work done. This will result in cheaper smelting, a better development of the industry as a whole, and result in the introduction of ore-dressing, which will in turn stimulate the exploitation of the lower-grade deposits.

Simpleefyde Spellin

The following example of natural spelling is the work of a shift-boss in one of the iron mines of New Jersey. We commend it to spelling reformers as suggesting such changes in the English language as they may see reason for advocating.

"July 22. Mike Fired all Over Tell Timber men them Bolts For 12 Chut is to short 2 inches to short tell them Kut Out Kuple them plonk for 1000 chut i lef all plok in Box Kut out that Long.

"Tell Big John Jess men vork in 1003 on Left Side machine Drill that Botom in Drift litle Loo can put no Track in them Drilling F Block Hole making Place for Track them Bolts vhat i Taking Down is By no 12 chut."

In 1913 the total production of coal in New South Wales, Australia, was 10,414,165 tons, and in 1914, 10,390,622 tons; in 1915 it decreased in consequence of the War to 9,449,008 tons, and reached the low-water mark in 1916, when there was only 8,127,161 tons produced. The production has increased again to 9,063,176 tons, and if there is no further disturbance in the trade the probabilities are that it will continue to materially increase, and there will be a better prospect for tonnage on American vessels to Australia, as they can discharge at Sydney and load coal at Newcastle, which is only about six hours run from Sydney by boat. The Government of New South Wales appointed a Federal commission to examine into the coal situation and ascertain whether an increase in wages, which would imply a sharp advance in the price of coal, would be justified. Following the appointment of the royal commission, the Federal government issued an order commandeering all the coal in the Commonwealth, and the miners have received their increase by about 3s. (72 cents) per ton from May 5, 1919.

The Guild in Labor Organization

By P. B. McDONALD

In these days of labor unrest, when a workable solution of the industrial problem is being eagerly sought, occasional references are made to the guild system of labor organization which worked so happily in the Middle Ages. The guild system gave satisfactory results for several centuries, during which many of the great Gothic cathedrals were built, and the Merrie England of those days appears so attractive in the light of history that modern students are comparing the medieval guilds with present-day trade-unions.

Mr. G. H. D. Cole, a writer in the British periodical 'Reconstruction', discusses 'Reviving the Guild Idea' as a promising phase of industrial democracy. Mr. Cole explains that the medieval guilds were made up of master-craftsmen with their journeymen and apprentices. The important point appears to be that the workers had control of the industry under a plan of self-government made possible partly by the local nature and informality of method of the enterprise. Each town was as nearly as possible self-sufficient, since centralization and intercommunication were as yet scarcely practicable, although journeymen traveled to pick up new ideas.

Mr. Cole suggests that a modern adaptation of the guild idea should have the following differences: The trade-unions can be taken as a basis, and salaried workers should also be included; these organizations should be related closely to the State somewhat as the guilds were to the municipality. There will be more and more tendency, the author thinks, for the State to own and control industry; he says, "the democratization of the industrial system will make possible a parallel democratization of the political machine." Thus he would have manual workers and brain-workers co-operating in great collective groups in which democratic control and social service would be the prevailing watchwords. A man would be cheered at his work by the thought that he was not a commodity, as labor is now, but a free sharer in an enterprise serving and controlled by society. The guild system would reconcile freedom and order.

The author of the article considers that society is evolving in the direction that he indicates, and that the transition can be made peacefully and gradually. He implies that the change may be consummated more surely and less wastefully if a study of the medieval guilds is made and discussed. As G. G. Walsh recently pointed out, in England during the 13th century among a population about equal to that of New York City, twenty magnificent cathedrals were built with an artistic craftsmanship and understanding of architectural effect that we cannot rival today. The guilds built these cathedrals, which are beautiful because they represent the free expression of men interested in their work and anxious to symbolize the eternal seeking for ideals of a race of human beings enshrouded in religious mysticism.

Probably there is nothing strikingly new in Mr. Cole's article. In the main, it is an argument for industrial democracy based on a scheme of organization and administration that gave excellent results seven centuries ago. He argues that "it is impossible to have a really democratic political system while the economic system remains undemocratic, and continues to be based on the denial of the humanity of labor."

Perhaps the first observation that comes to mind on hearing of such a suggestion is that it is not so much the machinery or scheme of a reform that is important as it is the phases of human nature with which the problem is associated. It is necessary to alter social ideals before a scheme will be found to work. There is something to be said for Carlyle's sarcasm about reforming by "tremendous cheers"; he pointed out that "no single man can reform himself without stern suffering and stern working; how much less can a nation of men." And the censor of his age continued, "Medea, when she made men young again, was wont to hew them in pieces with meat-axes, cast them into cauldrons, and boil them for a length of time. How much handier could they have done it by 'tremendous cheers' alone!"

The point is that the spirit is more important than the machinery; reform must come from within. If the modern employer and his employee can learn to understand each other better and co-operate more imaginatively by a study of the medieval guilds, more good might come of it than by calling a trade-union a guild and adopting some of the old customs. Without doubt a better knowledge of the workings of the guilds would help to elucidate some of the perplexities of modern industrialism, in spite of Henry Ford's observation that history is 'bunk'. Yet great historical betterments are achieved by changes in ways of thinking, just as the greatest gain from the War is said to be such a quickening of mind and conscience as people seemed too stupid to attain without being forced into it. How to get employer and employee to understand and appreciate each other, to cease from distrust and dislike, and to realize the interdependence of labor and leadership is a problem in education in the broader sense of that term. It could be helped by intelligent journalism, by the choosing of thoughtful political representatives, and by individual cultivation. The greatest hindrances to industrial improvement are ignorance, misdirected selfishness, and lack of imagination for putting oneself in the other's place.

MOUNTAIN COPPER COMPANY'S No. 1 CONCENTRATOR, LOOKING SOUTH

The No. 1 Concentrator of the Mountain Copper Company

By LLOYD C. WHITE

The crushing-plant is on Iron mountain, in Shasta county, California, at an elevation of about 2400 ft. The milling ore, which consists of chalcopyrite and pyrite in an alaskite-porphyry gangue, is delivered to the receiving-bin from No. 8 tunnel by electric haulage. The bin is covered with 30-lb. rails, spaced 10 in. centres. One man with a sledge-hammer breaks the oversize pieces. Another man feeds No. 1 conveyor from one of the six ore-gates. Referring to the flow-sheet, it will be seen that No. 1 conveyor has, at all times, a bedding of fine ore; this protects it in a measure from the large rocks, which strike the belt with considerable force. From No. 3 conveyor a small tonnage of high-grade chalcopyrite is picked for shipment direct to the company's smelter at Martinez, California. All the remaining ore is crushed to pass a 2½-in. ring and distributed by No. 4 conveyor to the storage-bin on the railroad. The crew at the crushing-plant consists of one foreman, one oiler, one feeder, one roustabout, three high-grade pickers, and one man at the grizzley. The capacity of the crushing-plant is 600 tons in eight hours. This is ample to supply the mill and allow the time necessary for repairs. A 100-hp. motor drives the plant.

The ore is hauled five miles over the Iron Mountain railroad to the concentrator at Minnesota station (elevation 1600 ft.). The narrow-gauge ore-train consists of a Shay engine and seven cars, each of 20 tons capacity.

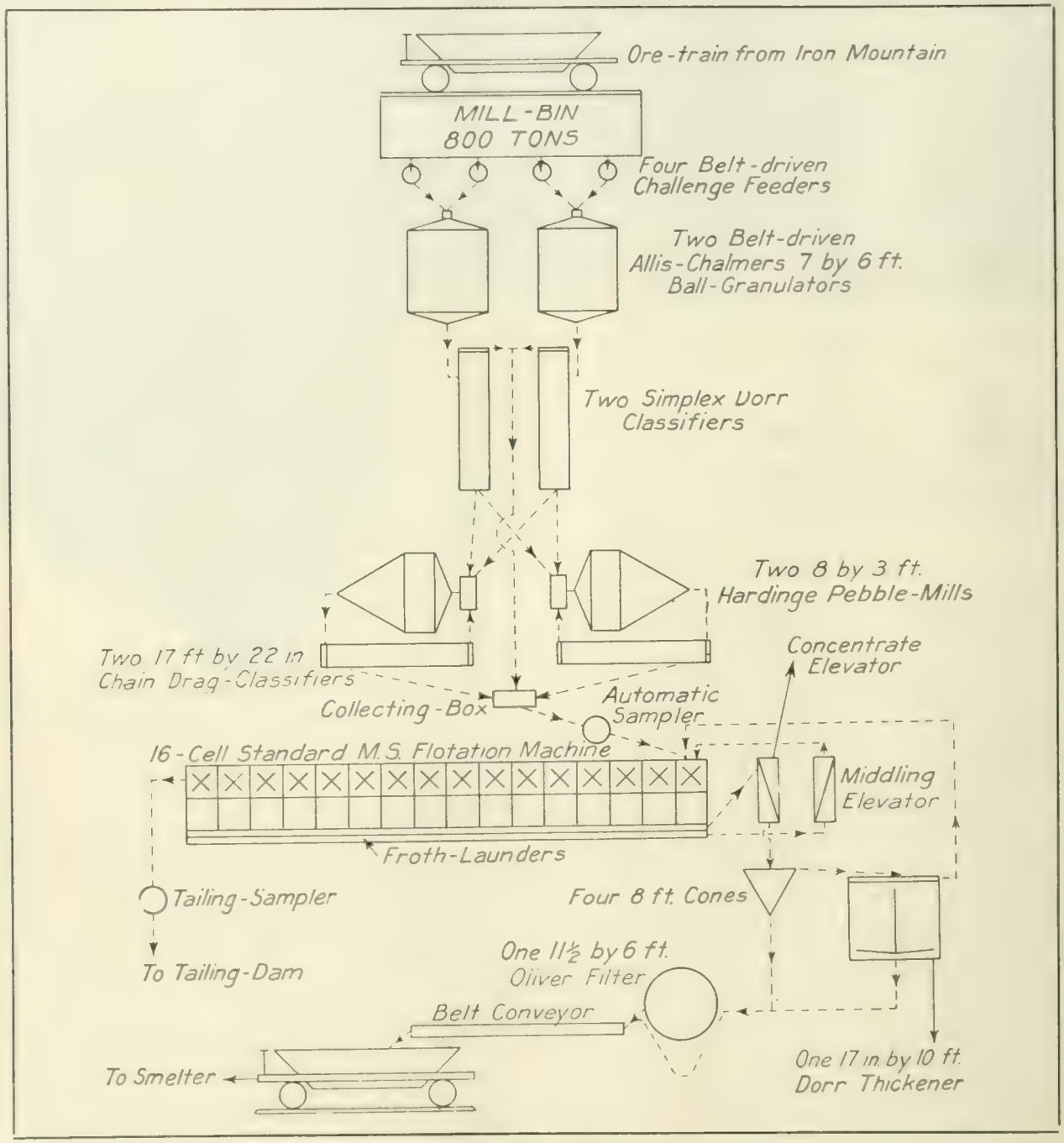
No. 1 Mill

The No. 1 mill was one of the first in California to use flotation. At the start it was of 200 tons daily capacity, but this was increased to 550 tons during the early part of 1917. This was accomplished by the substitution of two ball-mills in place of two sets of 16 by 36-in. crushing-rolls and the addition of two Dorr classifiers and a larger flotation machine. The grinding section is in two units so that the mill can always be operated at half-capacity when either ball-mill or Hardinge mill is shut-down for repairs. The ore is ground so that not more than 4% remains on a 60-mesh screen. Four and five-inch chrome-steel balls are used in the ball-mills with a consumption of 1.8 to 2 lb. per ton of ore. Chrome-steel liners have to be replaced about every four months. Most makes of ball-mills today properly installed and with ordinary attention give very little trouble. The principal thing, as with all machinery, is to make repairs the moment they are needed. Often near the end of the month the mill-foreman is so bent upon making a 'big showing' that he will put off all repair work until the first of the next month. In the case of mill-linings he often regrets this course when he discovers that the shell of the mill has been damaged. Open-end feeders for ball-mills grinding 2½ to 3-in. ore are a great improve-

THE No. 1 CONCENTRATOR, LOOKING NORTH, SHOWING ENGINE PUSHING BALL-MILL INTO THE BUILDING

ment over the pick-up type of scoop-feeder. With this latter type of feeder the ore builds up solidly from the bottom of the feed-box and becomes so hard that when an extra large rock becomes wedged between the revolving scoop and this solidified ore, something has to give way. I was in a mill recently where this had happened and the scoop was broken into several pieces. Not having a spare scoop on hand, they were obliged to gather up the pieces and rush to the nearest foundry, several miles distant, to have a pattern made and a new scoop cast; in the meantime the mill was running at half-capacity with resultant high costs, to say nothing of the inconvenience to the mine. An open-end feeder would have obviated this delay.

The mill-superintendent can usually improve on the design of liners for grinding-mills by observing which part of the liners wears out first and re-enforcing this part of the pattern. Two or three changes may be necessary, but finally a balanced liner is obtained which will wear out in all sections at about the same time, thus leaving a minimum of metal to be scrapped. It is perhaps needless to add that this is an important matter, considering the price of chrome-steel.



FLOW-SHEET OF MILL

The Hardinge mills require a minimum of attention. A set of W-B liners in the cylindrical part of the mill and one set in either direction last about ten months, while the liners near the trunnions last much longer. It is not necessary to unload the mills to make lining

renewals. Herringbone pinions driving these mills last 22 to 26 months. At present, pebbles from San Diego county are used, with a consumption of 6 to 7 lb. per ton of ore.

The flotation section consists of a single 16-cell 24-in. standard Minerals Separation machine. Should anything go wrong with this machine, the whole mill would have to be shut-down. This happens so infrequently that it is hardly worth mentioning. During nearly two years operation the only repairs on this machine have been two sets of impellers, box-linings, and one set of regulating-valves.

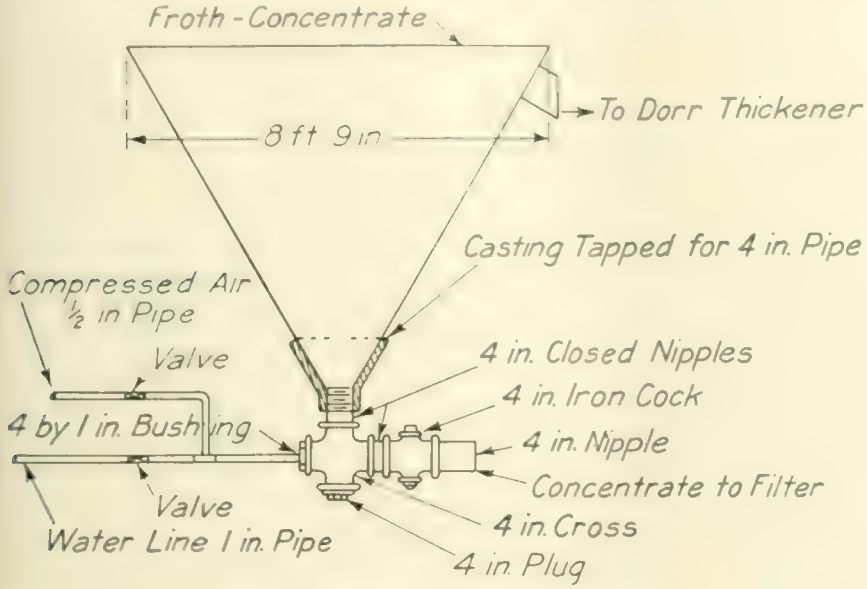
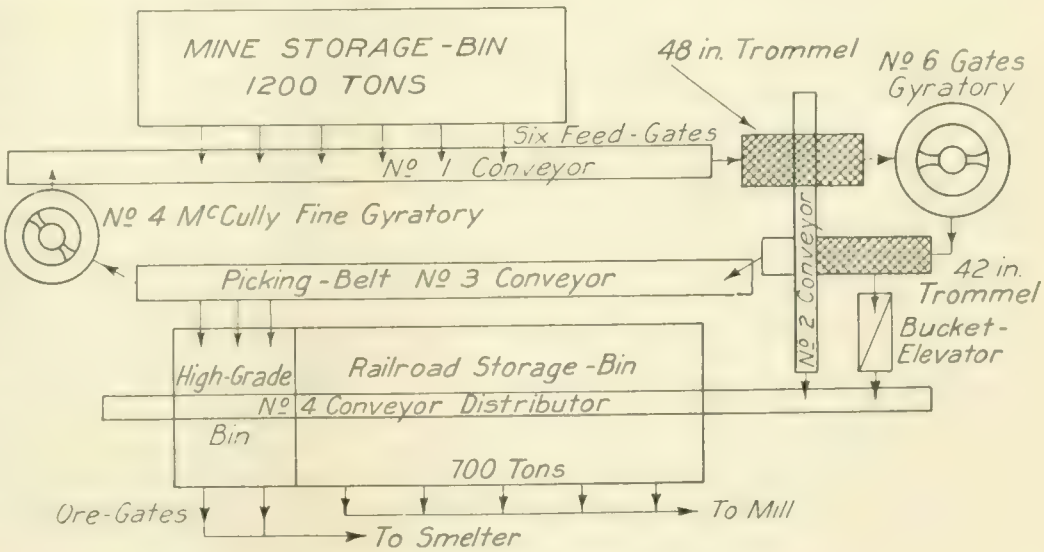


FIG. 1. SKETCH OF CONE-DISCHARGE

The ore averages about 2% copper, with 8% iron, and the concentrate runs about 15% copper. The average recovery is 92%. The ratio of concentration is about 7:1. The consumption of reagent averages 0.8 lb. per ton of ore; approximately 50% of the reagent used is kerosene-acid sludge, the remainder being a mixture of crude turpentine, tar-oil, and light fuel-oil. Oil is added ahead of the Hardinge mills, and oil and sludge are added to the impeller-boxes wherever required. The pulp is kept at about 30% solid. The froth from the last four to six boxes of the flotation machine is returned to box No. 1 for re-treatment. The froth from the remaining boxes is taken as concentrate and delivered by a bucket-elevator to one of four 8-ft. cones. The entire flow goes to one cone until it is filled, then it is diverted to another cone, and so on. The overflow from the cones goes to a Dorr thickener. Generally the froth breaks up readily, otherwise this cone system could not be used. One object of these cones is to provide storage for concentrate, so that it is necessary to run the filter only half-time. This storage also makes it possible to re-wind the filter without shutting-down the mill. The chief object of these cones, however, is to collect the coarser part of the concentrate, amounting to about 75% of the whole. This coarse concentrate is drawn to the Oliver filter, where it forms a cake two to three inches thick with a moisture content of about 9%. The colloidal part of the concentrate, which is drawn from the Dorr thickener, is filtered separately and forms a cake on the filter about ¾-in. thick, averaging 14% moisture. If the entire concentrate goes direct to the Dorr thickener and is filtered, the cake formed is about ¾ in. thick and averages 13% moisture. Thus it is seen that the cone system shortens the time of filtering and gives a final drier product, averaging something over 10% moisture.

After the concentrate has remained in a cone several hours it becomes quite solid; the cones are fitted as shown in the sketch (Fig. 1) to 'break-up' the concentrate. A little high-pressure water is added and then the compressed air is turned on; this causes the concentrate to 'boil' and is kept up for about 5 to 10 minutes, after which the concentrate is readily drawn to the filter. The concentrate is conveyed from the filter to the cars of the Iron Mountain railroad, to be hauled to Keswick and there transferred to broad-gauge cars that take it to the smelter at Martinez.



FLOW-SHEET OF CRUSHING-PLANT

The operating crew consists of one flotation man and

one oiler per shift. In addition to these men, three roustabouts on day-shift dump the ore-cars as the trains arrive, put in balls and pebbles in the grinding-mills, clean-up the mill, draw the flotation oil, unload supplies, do repair work, etc. There are two filter-men, but one of them devotes only half his time to filtering, being available for repair work, sampling, etc. Thus, including one foreman, a total of 12 men comprises the mill-crew.

There are eight motors in the mill with a rated capacity of 592 hp. Electric power is furnished by the Northern California Power Company.

TNT for Blasting

TNT is formed when toluene is treated with nitric acid in the presence of sulphuric acid. Toluene is a liquid substance which is produced from soft coal in the process of making coke, coal gas, and coal tar, and is recovered for use from both the gas and the tar. It is also made in other ways. The name TNT is an abbreviation of trinitrotoluene, which is the name given by chemists to the explosive in order to state its composition, and thus distinguish it from many other nitrotoluenes known to them. TNT did not become widely known until the Great War, when it came to be extensively used as bursting charges for high explosive shell, depth bombs, mines, torpedoes, and other devices, and in demolitions where very violent detonation effects were sought with the largest measure of safety from these effects to the users. It was also used in admixture with other substances to produce other military explosives such as amatol and sodatol. Because of the devastating effects produced by its explosion and because of many disastrous accidents which occurred during the manufacture and transportation of large quantities of TNT under the hurried conditions necessitated by war conditions, many have concluded that TNT is an especially dangerous explosive. In reality it possesses characteristics that render it less dangerous than many explosives generally used in our industries. Thus it has been found more difficult to explode with certainty than nitroglycerine, dynamite, or gun cotton.

With the cessation of hostilities this country found itself with large supplies of TNT on hand, so large that it was deemed unwise to keep all of it in storage awaiting future military use and it was proposed to devote many million pounds of it to industrial use. Although nitrotoluenes in admixture with other substances have been used as industrial explosives to a certain extent for more than a decade, TNT, for several reasons, but especially because of its special value as a military explosive, has not been used in industrial blasting except tentatively. It is not surprising therefore that objections should have been made to its suggested use as an industrial blasting agent. It may, however, be safely and efficiently used in industrial blasting operations by those skilled in blasting, as the results of careful experiments and observations made at the Bureau of Mines Experiment Station show.

When chemically pure TNT is a pale yellow crystalline substance which acquires a deep yellow to brown color on exposure to light. It melts at about 80.5°C., and when molten can be cast into molds, or granulated by chilling in water. TNT may therefore appear in granulated crystalline form, in pebbled or pelleted form, or in blocks or other cast forms. As offered by the Department of the Interior for use in blasting it is in the granulated crystalline form. The War Department secured and has alloted to the Department of the Interior for industrial use three grades of TNT as follows: Grade I having a setting point (S.P.) of 80°C.; Grade II, S.P. 79.5°C.; and Grade III, S.P. 76°C. It is more difficult to detonate with certainty than nitroglycerin, dynamite, or the explosives ordinarily used in engineering operations. Charges require a No. 8 detonator, whereas dynamite and the other high explosives ordinarily used in industrial operations require but a No. 6 detonator. As shown by tests all three grades of TNT are less sensitive to friction than 40% dynamite, gelatin dynamite, or picric acid, and all are less sensitive to percussion than 40% dynamite, ammonia dynamite, and nitrostarch powders. It may be set on fire, when it will burn, but this burning may change to a detonation. Hence TNT must be protected from fire and causes of fire, such as sparks, flame, heated bodies, friction, percussion, and the like, as all explosives should be at all times. It is toxic, but, unlike nitroglycerine, rather long contact with TNT is required before its toxic effects become of moment.

In tests made at the Pittsburgh Experiment Station by detonating TNT, Grade I, it was found that 454 grammes (one pound) of the explosive gave 506.5 litres of gases having the following composition: CO_2, 4.9% by volume; O_2, 2.5%; CO, 46.6%; H_2, 24.6%; CH_4, 2.6%; N_2, 18.8%. From this it appears that there was produced 46.6%, or 236 litres of a poisonous gas (CO) and 73.8%, or 373.8 litres of combustible gases (CO, H, and CH_4). The tests of other grades of TNT gave similar, though not identical results, but all indicate it to be unsafe to use TNT in close places, such as underground workings and particularly coal mines. These results emphasize the importance of remaining away from the face of the blast after the explosion until assured that the gases produced have been blown or have diffused away from the interstices of the debris. These precautions are such as should be taken with all explosives.

In determining the relative efficiencies of explosives in use, the Bureau of Mines has long employed the unit deflective charge and the rate of detonation as criteria. Taking 40% nitroglycerin dynamite as having a deflective power of 100%, Grade I TNT has a deflective power of 113%. This is considered the measure of the ability of an explosive to dislodge and bring down material in which it is exploded. Similarly the rate of detonation of Grade I TNT, which is considered the measure of the ability of an explosive to disrupt and shatter, is 99% that of 40% dynamite. Other grades of TNT show only slight variations from these figures.—C. E. Munroe and S. P. Howell in the Bureau of Mines.

Siberian Mines and Mining

By CHESTER W. PURINGTON

The years 1907 to 1915, inclusive, witnessed a remarkable activity in the development of a few of the gold and base-metal deposits of Siberia and the Ural, under the auspices of British capital and the technical control of American engineers.

Copper. The Kyshtim Mining Corporation was built up from the ruins of a semi-defunct Russian company which had mined copper in a desultory way for a period of nearly a century before 1919. About £900,000 sterling was raised in London by means of debentures, and pyritic smelting of the ore was introduced from abroad. This was found to be the salvation of the property, and under the able direction of T. J. Jones, R. Gilman Brown, D. P. Mitchell, and H. H. Knox, the Kyshtim from being an abandoned mine became the largest copper producer in the Russian realm. In 1916, the last full producing year, the output approached 15,000,000 lb. of metallic copper. This, although large for Russia, is only from one-quarter to one-tenth the output of the large 'porphyry' mines of the United States. A considerable output in gold was obtained yearly as a by-product.

The published reports indicate that when the mine was closed down owing to 'nationalization', some three million tons of 3% ore still remained in reserve. Much of the ground is still unprospected, and besides important iron deposits, which ore exploited successfully, an important discovery of nickel ore has been made. The cost of producing copper at this property in pre-war days compared favorably with the average cost at American copper mines. Following the political crash in Russia, the cost became prohibitive, and at the present time, since only destructive work is in progress in the Ural and in Russia, there is no demand for the product, even did the political conditions allow of the property being operated. It will probably take from three to five years to restore this property to its former productiveness, even after the restoration of peaceful conditions in the Ural.

Other copper mining properties in the Ural were the Sissert Co., the Verk-Isetz Co., the Bogoslof Co., the Revdinsk Co., and the Tanalyk Corporation. In the Kirghese steppe region, the Atbazar Mines and the Spassky Co. also operated in a small way. The last three mines mentioned were largely controlled by British capital.

Both the Sissert and the Revdinsk properties, near Ekaterinburg, were in the development stage, but with good promise for the future, the ore being in many respects similar to that at Kyshtim. The Tanalyk property, in the Orenburg district, although started as a copper mine, was proving to be a more important producer of gold than of copper when operations were suspended in 1917.

A most important copper deposit of the 'porphyry' type, that is, disseminated copper ore, is stated to have been partly prospected by drilling by the engineers of the Irtysh Corporation. This property is situated near the Ekibastus coalfield west of Pavlodar. In the published reports the company has merely referred to the deposit in a general way, but it is said to be of large dimensions.

Altogether the production of copper in Russia and the Caucasus in pre-war days was small, not filling the demand. It was infinitesimal as compared with what will be possible when the known deposits are exploited. Siberia, unquestionably the world's greatest store-house of copper as well as of gold, produced practically no copper previous to the closing-down of industry due to the revolution.

It should be noted that the price of copper in London has dropped during the past eight months from £153 per long ton to about £77 at last advices, so that notwithstanding the bounty of £23 odd per ton given by the Russian government to copper producers, it is not likely that domestic producers will be able to compete with imports for some years to come. Probably the first successful copper mining on any considerable scale will be in the porphyry deposits, which can be mined by open-cut with steam-shovels, a minimum of hand labor being required.

Lead, Silver, and Zinc. The two well-known base-metal districts of Siberia are the West Altai and the Nerchinsk-Argun. A less known region recently developed for the production of zinc is the Te-Hu-He, about 200 miles north of Vladivostok, only 20 miles inland from the coast.

Notwithstanding the fact that the Nerchinsk mining district was known over two hundred years ago, it, like the Altai, is still in the development stage. Both these districts are extensive, as large as whole States in the United States or Mexico, and contain deposits of great importance. They have both been held since discovery as the private property of the Russian Crown, only lately abolished. An antique system of administration retarded the development of lead and zinc mining in both the Altai and Nerchinsk mining regions and stifled any attempt at industry. A certain amount of silver was produced from rich surficial ores during the past century and a half, largely by forced labor.

In 1912 the Russo-Asiatic Corporation was formed in London, and D. P. Mitchell was sent to examine the so-called Cabinet Concessions in the West Altai. He selected the three largest mines, the Ridderski Kope, situated about 50 miles north-east of Ust-Kamenogorsk. A lease was obtained from the Cabinet of the late Czar, and

the Irtysh Corporation, with a capital of £2,000,000, was founded to develop and operate the property. This company also obtained the control of the Ekibastus coal mines, formerly part of the Popof properties, west of Pavlodar, and connected with the Irtysh river by 50 miles of standard-gauge railway. In the past five years, up to 1917, another railway has been constructed by the company, connecting the Riddersk and Sokolni mines with the Irtysh. Coke-ovens and zinc-retorts have been constructed, a concentrating plant has been erected at the mines, and a large amount of development and diamond-drilling has been accomplished on the ore deposits. Some of the best mining and metallurgical talent has been employed, and the problem of treating the complicated base ores has been solved. All preparations were made for a regular and profitable output of zinc, lead, silver, and gold, which were the four principal recoverable metals present in the ore.

It is estimated by competent engineers that the amount of ore in the Riddersk and its neighboring mine the Sokolni was sufficient on a conservative basis to net the shareholders £10,000,000 in the course of ten to twelve years after operations were well under way. This was only estimating ore at a moderate depth in two deposits, while over twelve other deposits of the famous 'hornstone' were known on the property, where surface indications were of similar character to these developed mines. Beside this the coal mines of the company were under competent management and a large amount was spent in preparations for a steady production, both for coking purposes in smelting the ores and for filling contracts with the Trans-Siberian railway.

It should be noted that the estimated production of the Riddersk mine in gold, merely as by-product, amounted to £1,000,000 annually, or as much as the average production of the Lenskoie Gold Mining Co. previous to 1915, which produced 25% of the gold output of Siberia. It is one of Russia's unwritten tragedies, not yet realized, that this fine fabric of industry, the result of the considered thought and well-directed energy of high-class specialists, should be brought dangerously near the verge of destruction just on the eve of its fruition, by the senseless acts of those who stood to gain the most good from it.

Other portions of the Altai zinc-lead domain have been developed by the Russian Mining Corporation, of London, and this company in 1916 made copper discoveries which may prove of importance. Altogether, it is stated that 4000 prospects exist in the Altai region showing silver-lead ores, only a small percentage of which has been worked or even looked at during the past three or four decades.

The Nerchinsk mining region, known to English readers since the time of Robinson Crusoe, who may be said, if one is to believe De Foe, to have been the first Trans-Siberian traveler, has not been the object of modern development. There are indications that it may yet become the seat of profitable base-metal mining, and it is perhaps fortunate for the future Siberian commonwealth that this great area has, as it were, been protected from half-hearted private exploitation in the past by the old Cabinet system. Under that regime the convicts merely 'gophered' the rich streaks of silver ore near the surface and did not attempt any systematic mining of the larger masses of lead and zinc ore.

The Coast region, as has been stated, boasts the Te-Tu-He zinc mine, which has produced in the past few years a notable quantity of high-grade ore, and is not unlikely to be of importance in the future for the production of mixed base ores on a considerable scale. This region has the great advantage of being near tide-water, and therefore is not dependent on domestic market for the concentrate and spelter it produces. Ample deposits of coking coal are also available in the vicinity; therefore, should these ore deposits prove extensive, it is highly probable that the southern Sikota Aline may become the seat of an important lead and zinc smelting industry.

Gold. Alexander von Humboldt is authority for the statement that gold has been mined in Siberia since the time of Herodotus, and the probability is that it was mined many centuries before that historian was born. All travelers in the southern Altai agree that ancient workings are numerous, although dates are not assigned. It is highly probable that much of the gold wrought into personal ornaments by the Greeks of the Chersonese found its way there from the Altai.

The recorded production of Siberia and the Ural since the middle of the 18th century is something under $1,500,000,000 and with the thieving and illicit production which is the invariable accompaniment of gold mining, one may place the output during this historical period at not less than $200,000,000. The greatest single contributions to this output have been from the North Yenesei district and the Vitim district, which may be estimated at $250,000,000 and $400,000,000 respectively.

In 1754 a 12-stamp mill was erected by a German engineer at Bereozovsk, near Ekaterinburg. The property on which this mill operated has continued to produce both quartz and placer gold with more or less regularity up to the present day. Up to 1820, when the location of claims was first allowed by private parties in Siberia, the Ural produced most of the gold recorded. Quartz mining was never an important factor, and placer mining became the chief source of the metal.

In the late 30's, the North Yenesei came into prominence, and several years before the discovery of gold in California this district was producing at the rate of from $5,000,000 to $7,500,000 per year. About 1842-'50 the deposits became exhausted according to the standard of work carried on, and the miners migrated east. One Trapeznikof located a claim on the Homolko river, a branch of the Zhuya, in the Olekma district in 1847, and there was a rush to the district, now famous the world over as the Lena.

It was not, however, until 1867 that Michael Sibiryakof located the Blagoveshensky mine on the Nakatami, a branch of the Bodaibo creek, tributary to the Vitim, and is said to have found by chance the deep-lying gravel that has since made this stream and the Bodaibo known wherever placer mining is talked of. The claim men-

MAP OF PARTS OF SIBERIA AND MONGOLIA

tioned proved the richest gold-gravel area of which we have record in the world, 1,000,000 cubic yards of bedrock gravel having produced $15,650,000.

The fame of Bodaibo creek, which may be safely estimated to have produced over $200,000,000 in 40 miles of length is too well known to need description. Areally considered it is but a fraction of the gold-bearing territory of the Vitim and Olekma districts, and although worked out by the present Lenskoie company, there still remain important reserves of gold to be worked by modern contrivances.

Up to 1914 the methods of drifting used by the Lenskoie Gold Mining Co. were of that archaic description introduced into the Ural by some disciple of Agricola in the time of Katherine the Great. The so-called washing machines were of great historic interest, and one regretted that on account of their bulk it was impossible to transport them to some museum of antiquities in one of the world's great capitals. Fortunately, in 1913 Reuben E. Smith, a mining engineer and specialist on placer mining, was engaged by the company. He at once set to work to improve the methods employed, and in the course of three

THE THURN & TAXIS CONCESSIONS IN THE ALTAI REGION

years in the face of most intense opposition by the Lenskoie board and many of the local officials of the company, succeeded in greatly reducing the cost and increasing the gold output. Stealing of coarse gold from the drift faces and dumps which had for several years past averaged $1,500,000 annually, was reduced to less than $500,000 in 1915. This was the result of the introduction of all-the-year washing of gold instead of exclusive summer washing as formerly. A most ingenious system was developed by Mr. Smith which allowed of the gold being washed every day of the year, even at the record winter temperature of 1914-'15, when on the coldest day 88°F. below zero was recorded.

By this and other improvements, such as the introduction of standard Alaskan sluices, it became possible to save the fine gold which had formerly been lost. The output was gradually raised until in 1915 the record output of this property of $9,000,000 in gold was recovered in one year. This, in fact, was the largest output in that year of any gold mine, either quartz or placer, in the world.

Underground improvements, such as the recovery of timber put into the workings, the reduction of man and horse power, and all-round general cost-cutting factors had been introduced and the Lenskoie property so far as working cost and production were concerned was fast getting in line with the world's well administered mines; but, unfortunately, the board at Petrograd had engaged the doctor when the patient had nearly expired, and the inevitable fact remained that Bodaibo creek was worked out. Therefore, irrespective of any political disturbances, the Lenskoie output began to decline in 1916, and has done so steadily since. Although it is reported that the property is still being operated, the 1919 output will probably not reach more than 20% of the 1915 output.

New discoveries of 'drifting' gravel are reported from eastern areas of the property, remote from Bodaibo. While it is possible that these will lend for a time a new life to the property, a thorough liquidation of the present organization will be necessary before even the richest gravel can be worked at a profit. Ancient poodage rights, imports, etc., exist on many of the best claims, serving to handicap their profitable exploitation, even were all the unnecessary overhead charges eliminated.

Outside the Lenskoie company, the output of any one mine in the Siberian or Ural territory is insignificant. The aggregate pre-war annual output of Russia was from $25,000,000 to $30,000,000 in gold. This was less than the daily cost of the war to Great Britain. Of this sum, the Lenskoie company annually contributed from 25 to 30%. Thus, notwithstanding the fact that Siberia promises to be the world's great gold-producing country of the future, it may be said to be at that turning point where the alluvial gold is largely worked out and the initiation of quartz mining, and the obtaining of gold as a by-product from base metal mines, has not commenced.

To select the areas where deep mining will be possible, and to develop the deposits, and apply the proper processes for extraction of the metal will require the services of foreign engineers from America, South Africa, and Australia. There is no intrinsic reason why the Siberian output should not eventually equal or even exceed the present annual output of the Transvaal, but the evolution of the industry will be slow, as it has been in other countries.

Gold-dredging, which has attained success in other countries, will also have a wide field, but up to the present it has hardly commenced. Out of some 50 dredges that have hitherto been installed in various districts in Siberia, only about five are of any value as machines. Two of these are on the Pacific Coast, on the property of the Orsk Goldfields, and three are in the Ural, at the property of the Nikolai Pavdinsk company. Gold-dredges are only significant in increasing notably the gold production of a region when they are installed in multiple units on large

areas, since the recoverable content of the gravel on which they operate is generally very low, a few cents per cubic yard.

Platinum. I am credibly informed that 27 so-called dredges in the Ural region, mostly on the Iss and Tagil fields, were sunk during the political disturbances, but with one or two exceptions, one may say that the loss of these mechanical contrivances is not greatly to be deplored. For the sake of the future of the platinum industry, it is to be hoped they will remain scrapped and be replaced by modern dredges.

The entire platinum output before the War averaged about 150,000 oz. troy annually, and so far as can be gathered it dwindled to 80,000 oz. in 1917. The Iss field, by far the most important, if worked intensively by dredges for ten years with an annual output of say 300,000 oz., would probably be exhausted. It is not unlikely that other platinum districts will be discovered, either in the Ural or elsewhere, to take the place of this field when exhausted. It is also possible that certain zones of the Iss dunites may be found workable as a rock-source of platinum, since it is known that the platinum occurs in the dunite in recoverable quantity. The same may be said regarding the adjacent less important fields of the Pavdinsk estate and the Tagil.

The gold deposits of the Oatman district, Arizona, occur in fissure-veins that traverse all the rocks of the region. The veins apparently are identical in character and are equally mineralized and of the same vein-matter in all the rocks, which consist of andesites, trachytes, rhyolites, latites, and basalts.

'The Survey of Cornwall'

By J. C. MURRAY

There is both refreshment and profit in discovering for one's self the points of view of old writers on matters pertaining to mining. Mirth and edification walk hand in hand as one reads the pages of the volume whose title is displayed above.

Richard Carew, the author of 'The Survey of Cornwall', was born in the year 1555, at "East-Antonie, in the eastern part of Cornwall, within some miles of Plymouth". As a youth such was his precocity that he became a gentleman commoner of Christ Church when but 11 years old. At 14 years of age he engaged in a public debate with the "matchless" Sir Philip Sidney. Concerning his subsequent career, there are but hazy accounts. What is certain is that he became an ardent observer of natural history.

In the year 1602, Carew published his 'Survey of Cornwall', and dedicated it "to the Honourable Sir Walter Raleigh, Knight, Lord Warden of the Stannaries, Lieutenant Generall of Cornwall". His dedication is more than ordinarily ingenuous and naive. It commences:

"This mine ill-husbanded Survey, long since begun, a great while discontinued, lately reviewed, and now hastily finished, appealeth to your (Lordship's) direction, whether it should passe; to your correction, if it doe passe; and to your protection, when it is passed."

He prays that "each wel-minded Reader will wish a merrie passage, to this my rather fancie-sporting, than gaine-seeking voyage;" and, before getting down to real business, he indites a charming little "Prosopopeia" of five verses, one of which runs thus:

> "I curry not with smoothing termes,
> Ne yet rude threats I blaste:
> I seeke no patrons for my faults,
> I pleade no needless haste."

Herefrom could many an over-deprecatory author learn wisdom!

Nearly every page of the 'Survey' is tempting. However, we must content ourselves with those touching on mines and mining.

A brief sketch of the topographical features of the 'Duchy' closes with the remark that "in the rest of this earthy description, I will begin with such minerals as her bowels yeeld forth..... These minerals are not so deepe buried in the entrailes of the earth, nor so closely couched amongst the Rockes, but that desire of gaine with the instrument of Art can digge them up: they may be divided into stones and mettals."

Quarry-stones, pebbles yielded by the "sea-strond", slate, and limestone are successively dealt with. As to copper, our author confesses to small knowledge and less curiosity; for he states that at one mine the ore was shipped to Wales to be refined, whether to save cost of fuel, or to conceal the profits, he does not care to venture a guess.

Silver is dismissed with the statement that although it is found, nature has not been lavish, for "what she proffereth with the one hand, shee seemeth to pull backe with the other."

The tin miners, Carew asserts, found "little hoppes of Gold" in their ore. These they kept in quills and sold to goldsmiths, but with little or no profit.

Diamonds, he declares, are found cleaving to the rocks in which tin is mined. "They are polished, squared, and pointed by nature," from which we may estimate Mr. Carew's acquaintance with crystallography.

On tin our worthy observer becomes eloquent: "But why seeke wee in corners for pettie commodities, when as the onely mynerall of Cornish Tynne openeth so large a field to the Countries benefit? this is in working so pliant, for sight so faire, and in use so necessarie, as thereby the Inhabitants gaine wealth, the Merchants trafficke, and the whole Realme a reputation: and with such plentie thereof hath God stuffed the bowels of this little Angle, that .... it overfloweth England, watereth Christendome, and is derived to a great part of the world besides." Thus delightfully does Carew ramble in dithyrambic prose.

Amongst other things, we are told of the Cornish miner's belief that Noah's flood, moving from east to west, on its course to the sea, produced by denudation all the alluvial tin. Stories of the discovery of tin veins ("loads") by means of dreams are repeated, though the author carefully refuses to guarantee their credibility.

Prospecting is described succintly, but picturesquely, in one paragraph. "Shoad", the drift "shed from the maine Load, and made somewhat smooth and round, by the waters washing and wearing" is sought for by casting up trenches five or six feet deep and three or four wide. Rivers are turned from their courses, a practice to be condemned as being "little beneficiall to the owners of the soyle" since the low grounds have "herethrough their wrong side turned outwards."

Prospecting to find the "loadworkes" begins by "conjecturing by the sight of the ground which way the flood came that brought it thither, and so give a gesse at the place whence it was broken off." At that place a shaft five or six feet by two or three feet is sunk to a depth of seven or eight "to prove whether they may so meete with the Load" .... "But", advises the cautious Carew, "you may not conceive that every likelyhood doth ever prove a certaintie: for divers have beene hindered.

through bestowing charges in seeking, and not finding, and many undone in finding and not speeding, whiles a fair show, tempting them to much cost, hath, in the end, fayled in substance, and made the adventurers Banckrupt of their hope and purse." A fair epitome, this, of the whole matter.

Carew speculates engagingly as to whether or not tin minerals grow in the rock. He discreetly leaves the question open after quoting authorities *pro* and *con*. A rich tin vein is described as one that "carrieth a foote and a halfe in breadth, and is not overbarren," a definition worthy of the most non-committal geologist of today. To work such a vein, the discoverer, unless his purse is "lined beyond ordinarie," associates himself with some more partners, who are either practical 'tinners' or else adventurers willing to contribute money. The laborers, be it noted, worked for eight pence per day, or, if paid by the year, for from four to six pounds, out of which wages they paid their own keep.

Should the new mine assume respectable proportions it was duly christened and a mine overseer, or captain, appointed. In most places, according to Carew, the toil was so extreme that a shift lasted only four hours, no miner working more than the one shift. "The residue of the time they wear out at Coytes [quoits], Kayles, or like idle exercises. Their Kalinder also alloweth them more Holy-dayes than are warranted by the Church, our lawes, or their own profit." Carew had first-hand experience of the Cornishman's passion for pastimes, some of them so strenuous as to result in serious wounds and even in deaths. Farther on in the 'Survey', in discussing the rough game of 'Hurling to the Countrie', he remarks that the players retired home as from a pitched battle. Yet there was always evident the sporting spirit. "All is good play, & never Attourney [lawyer] nor Crowner [coroner] troubled for the matter."

To proceed with mining, however. The manner of working was "to follow the Load as it lieth, either sidelong, or downe-right."

But here our friend Carew falls into heterodoxy by asserting that "both waies the deeper they sincke the greater they find the Load." Alluding to open stopes, he states that "from some of their bottomes you shall at noone dayes discrie the Starres." The miners were let down and hoisted up in a 'stirrup' by two men on a windlass. Shaft-sinking and drifting and the problems of ventilation are mentioned. Sympathy is expressed for the poor miners who meet death through falls of rock. Foul air and mine-gases are thus touched on. "While they [the miners] thus play the Mouldwarps, unsavorie Damps doe here and there distemper their heads, though not with so much daunger in the consequence, as annoyance for the present." Sometimes the rock was so hard that a good workman could "hew" only three feet in as many weeks. Pumping was effected by man-power, horse-power, and water-wheels where drainage could not be had by means of "addits" (or "audits"). Carew marvels greatly at the engineering skill of "otherwise thicke clouded braines" in driving these "audits".

He is also wonder-stricken that the operators should be "anyway able to acquite the cost" of the subsequent dressing, breaking, and stamping of the ore. The stamp-mill of the day, to which the ore was conveyed either "in waynes or on horses' backs," consisted essentially of "three, and in some cases sixe, great logges of timber, bound at the ends with yron, and lifted up and down by a wheele, driven by the water." From the stamping-mill the ore passed to the "crazing" mill, where it was fed between two grinding-stones (actuated by water or man-power) and there "brused" [bruised] to a fine sand.

But innovations were already creeping in. "Of late times," the author remarks, "they mostly use wet stampers, and so have no need of the crazing mills for their best stuffe, but only for the crust of their tayles."

The process of concentration was carried on by means of riffling the crushings over green turfs, three or four feet square and one foot thick. The concentrate was put into a wooden dish, broad, flat, and round, "being about two foote over, and having two handles fastened at the sides, by which they softly shogge the same to and fro in the water betweene their legges, as they sit over it, until whatsoever of the earthie substance that was yet left, be flitted away." But mark again the march of progress. "Some of later time, with a sleighter invention, and lighter labour, doe cause certaine boyes to stir it up and downe with their feete, which worketh the same effect."

Each partner in the venture then carried his portion to the 'blowing house', where it was melted and cast intc "peeces of a long and thicke squareness, from three hundred to foure hundred pound weight, at which time the owners mark is set thereupon." Once again Carew marvels wherein can lie the profit in going to such extraordinary pains—two or three months of extreme and increasing labor, numberless dangers and vicissitudes, and, last, but not in his opinion least, the "tynners" ugly countenances, tanned "with smoake, and besmeared with sweate."

The melting was done in lightly constructed thatched buildings. Once in seven or eight years these were burned down to recover the mechanically lost tin.

After reference to "coynage", the account concludes with allusion to the bargaining between metal-buyers and sellers. The former brought long tales of bad markets, idle stocks, dangers of piracy by sea, rumors of war, and so on, in their efforts to depress prices. "The owner, on the other side, stoppeth his eares against these charmes," and grows eloquent on the scarcity of tin and the waxing expense of winning it.

It is impossible to reproduce the charm of Carew's volume. Part of it lies in the quaint and uncertain spelling, part in the diction, which is tinged throughout with Cornish idiom despite the author's Oxford erudition. But mostly it consists in remarkable keenness of observation and frankness of expression, together with a gift for moralizing that is typical of the spacious times in which Richard Carew, Esquire, of Antonie, in the Duchy of Cornwall, lived, moved, and had his being.

The Deepest Well

During the last few years the Hope Natural Gas Co. and the People's Natural Gas Co., both of Pittsburgh, Pennsylvania, have been drilling deep wells in northern West Virginia and south-western Pennsylvania to find deeper oil-bearing and gas-bearing sands, their object being to reach, if possible, the horizon of the rich Clinton sand of Ohio, which, according to I. C. White, the State Geologist of West Virginia, should be found in this region at depths between 7000 and 8000 feet.

The first exceptionally deep well thus drilled, the R. A. Geary well, of the People's Natural Gas Co., is about four miles north-west of McDonald, Pennsylvania, and about 20 miles south west of Pittsburgh. The mouth of the well is 1050 ft. above sea-level. It penetrates the Gordon stray sand, the last of the usual gas-sands in this region, at a depth of 1971 ft. From this point to a depth of 6700 ft. the strata penetrated are alternately lime and slate, and from 6700 ft. to the bottom, 7248 ft., they are sand and lime interspersed with about 60 ft. of rock-salt. The second deep well was drilled by the Hope Natural Gas Co. on the farm of M. O. Goff, about eight miles north-east of Clarksburg, in northern West Virginia. Its mouth is 1164 ft. above sea-level. The well begins 200 ft. below the level of the Pittsburgh coal and penetrates the usual oil-bearing and gas-bearing sands, the lowest being the Bayard, which lies at a depth of 2210 ft. The strata in the remainder of the well are alternately lime and slate. The third deep well, the J. H. Lake, of the Hope Natural Gas Co., is about eight miles south-east of Fairmont, West Virginia. It is about 20 miles north of the Goff well and about 60 miles south of the Geary well. The mouth of the well is 1300 ft. above sea-level. The Bayard sand, the lowest of the gas-sands, was found in this well at a depth of 2050 ft. The remaining strata are alternately lime, slate, and sand.

Named in order of depth, the four deepest wells in the world are the Lake, 7579 ft.; the Goff, 7386; a well at Czuchow, Germany, 7348, and the Geary, 7248 ft. The two deepest wells in the world are therefore the Lake and the Goff, the Lake surpassing the German well by the large margin of 231 ft. In comparison with these great depths, other depths reached by wells or mines sunk in the crust of the earth are rather insignificant. The deepest mine in the world is shaft No. 3 Tamarack, in Houghton county, Michigan, which has reached a depth of 5200 ft. Other shafts of the Tamarack Co. and of the Calumet and Hecla mine, in the Lake Superior region, reach depths between 4000 and 5000 ft. Three shafts in the Przibram silver mines in Austria have reached depths of about 3300 ft. The Victoria quartz mine, at Bendigo, Australia, is 4300 ft. deep. A number of shafts in the Transvaal gold region of South Africa have been sunk to depths of about 4000 feet.

The depth to which a mining shaft can be sunk is limited by the heat of the rocks, as the temperature at a depth of a mile in nearly all parts of the earth is so high that workmen cannot live in it, even with ventilation. The depth to which a well six inches in diameter can be drilled seems to depend on skill in drilling and strength of cable. The cable itself is heavy, and besides carrying its own weight and the weight of a drill, which weighs 1 or 2 tons, it must bear strains produced by vertical movements of the drill, which may be so great as to break it at any moment, so that the drill and a part of the cable may be lodged in the well in such a way that they cannot be removed. Exceptional skill is required, therefore, in operating the ponderous machinery used in drilling a well. The drill, which is a column of steel about five inches in diameter and forty or fifty feet long, beveled to a V-shaped edge at the lower end, is attached to one end of the cable, and at some other point, determined by a driller, the cable is attached to a long beam, which is operated in the same manner as the walking-beam of a steamboat. Merely to lift the drill through the height determined by the swing of the end of the walking-beam and to let it drop repeatedly would do no drilling. In order to drill, oscillations must be induced in the cable, such as those set up by attaching a light weight to a suspended rubber band. A slight oscillation properly induced by the finger at the upper end of the rubber band will produce a very large oscillation of the weight attached to its lower end. In some such way as this the skilful driller produces oscillations in the drill-bit, which throw the sharp beveled edge of the drill onto the rock with high velocity. The only means that the driller has of knowing the behavior of the drill is the general behavior of the machinery and the slight impulses or tremors in the cable, which he detects by his hand alone.

The materials and the conditions in the interior of the earth have long been a favorite subject of speculation among scientific men. According to the modern mathematical theory of the propagation of earthquake waves through the earth the outer rocky shell of the earth, which is about two and one-half times as heavy as water, extends to a depth of less than 1000 miles. Inside this shell is some material, probably metallic, which is more than five times as heavy as water. Estimates of the temperature at the centre of this nucleus range from 3000° to 180,000°F., but these figures have little or no value, for mathematicians have not yet found the law of the distribution of temperature from the surface to the centre of the earth. The temperature evidently increases with the depth, a fact again confirmed by an elaborate series of observations of temperature made in each of the three deep wells, the Geary, the Goff, and the Lake, by C. E. Van Ostrand of the Geological Survey. In each of these wells the temperature at a depth of 100 ft. is about 55°F., and gradually rises with increase in depth, reaching 142° in the Geary well at a depth of 6100 ft., 159.3° in the Goff well at a depth of 7310 ft., and 168.6° in the Lake well at a depth of 7500 ft. The observation at a depth of 7500 ft. in the Lake well was made at the deepest point yet reached by any observer.

The source of the enormous quantity of heat stored in the interior of the earth is not known. Some writers

holds this heat is due to the disintegration of radium in the rocks; others think that the earth is a cooling globe, radiating heat developed during condensation from the original nebula, and others think that it is due to various causes, such as radio-activity, chemical reactions, impacts from meteorites, or condensation from nebulous material.

The strata of lime, slate, and sand penetrated by these deep wells were originally sediments deposited from ocean water. A bed of ocean water was actually found in the Geary well at a depth of 6260 ft. Dr. White is of the opinion that this water is a fossil ocean, imprisoned since mid-Paleozoic time. Interesting evidence in regard to the geologic history of the formations was obtained by Charles Butts of the Geological Survey, who identified a number of fossils from depths of 7187 to 7355 ft. in the Goff well. The material from the Lake well has not yet been fully examined. It may be possible by examining the fossils to determine the geologic ages and horizons of the beds penetrated, and so to estimate the depth at which the Clinton sand should lie beneath the bottom of this well. The well probably does not pass through more than one-half the total thickness of sediments in this region.

Mining in California in 1919

The outstanding feature of metal-mining in California during the first half of 1919 is the closing down or the restriction of the operations of some of the principal productive deep mines. A number of mines, according to C. G. Yale, of the U. S. Geological Survey, have been closed by labor strikes; others by the low prices of the metals produced, the high cost of labor and supplies, the scarcity of skilled labor, and high taxes and other war conditions. Moreover, for the last few years there has been a manifest disinclination to invest capital in metal-mining, especially in the older centres of the industry. The copper and lead mines have been most affected by these conditions, but the larger deep gold mines have also had their troubles. The gravel mines, especially the dredging properties, have not been so seriously affected as the quartz mines, yet their costs have greatly increased and they have had difficulty in obtaining sufficient competent labor. The war surcharge cost for electric power has been the greatest burden borne by the gold dredgers, who assert that the voltage has gone down while the rates have gone up.

During the first six months of 1919, the United States Mint and the local smelters and refiners, to which most of the newly mined gold in California is sent, received from the mines in the State $390,573 less gold and $24,511 less silver than during the first six months of 1918, but as the annual output of gold is now $17,000,000 to $20,000,000 this difference in the output during the first half of the two years is insignificant. In 1918 there was a falling off in the production of gold, compared with 1917, of over $3,500,000, but the small loss in the first half of 1919 compared with that in the first half of 1918 shows that the decline in output has been materially checked and that under normal conditions the output of gold in the State will take the up-grade. In this connection it should be noted that the reduction in the quantity of gold produced may be attributed to a decrease in the output of the larger mines. The number of producing mines in the State has increased during the last year or year and a half, but the increase in number is really among the smaller mines, especially the deep or quartz mines, which after a few years of idleness are now being re-opened.

The Mammoth plant of the United States Smelting & Refining Co., the most productive mine in California, all metals considered, ceased operations on May 15, because of labor trouble. The closing of the smelter stopped work at a number of mines, which had been shipping ore to it, including the Afterthought mine. The Penn Mining Co., mining copper in Calaveras county, ceased operations, and the output of the Calaveras Copper Co. was curtailed. A number of copper properties in other counties also stopped work, owing to the low price of the metal and the scarcity of labor. The most productive lead and zinc mine in the State, the Cerro Gordo, in Inyo county, also closed down because of labor trouble. A fire in the Argonaut mine, Jackson, Amador county, the most productive of the Mother Lode mines, stopped work there for two months, but operations were resumed on June 1. Fumes from the fire hampered work in the adjoining Kennedy mine, another large producer. A miners' strike at Grass Valley, Nevada county, the region including the most productive deep gold mines of California, curtailed for a time the gold output of the North Star and other large properties. The larger mines have reduced their working force and will not be able to operate to advantage for some time. The lower levels will have to be pumped out.

It is pleasant to note renewed activity at the gravel mines, particularly at the hydraulic and drift mines. In Trinity and Siskiyou counties a large number of mines that have been more or less idle have given good accounts of themselves this year, when an abundance of water was available. Some of the townsites—old historic places like St. Louis, Sierra county—are being hydraulicked, the towns having been abandoned. In the same region hydraulic mining on a large scale is contemplated also at Howland Flat, Port Wine, La Porte, and other mining camps whose history can be traced back to 1849. Work at numerous silver-lead properties in Inyo and San Bernardino counties has been started within the last six months. Some of these are old mines, which have been idle for 20 years or more. Rich silver ores have recently been discovered near Randsburg, in Kern county, and their discovery has stimulated active prospecting throughout that region. The deposits are being mined with local capital.

No. 121 of the technological papers of the Bureau of Standards has just been issued. This pamphlet sets forth the results of tests and experiments made to determine the strength and other properties of wire-rope.

REVIEW OF MINING

COLORADO

GENERAL NEWS OF THE SILVERTON DISTRICT.

SILVERTON.—Production from the district is not very heavy, although a large amount of development work is under way. The rising price of copper will be an incentive to many of the smaller operators of the district to ship, but the present price of lead, on the other hand, does not encourage some of the operators to continue. The Gold King Extension Mines Co., after a successful mill run of several weeks, closed down to make some changes in the method of treatment. It is expected that operations will be resumed at an early date. The Iowa-Tiger Mining Co. has a force of men engaged in raising to connect the 200-ft. and the 400-ft. levels, in order to improve ventilation. After a few weeks, during which the entire force was engaged upon development work, shipment was resumed. A profitable vein of high-grade lead ore is now being worked. Construction work on the Sunnyside company's boarding and bunk houses continues and is progressing rapidly. A tailing dump is being worked over and a good recovery of zinc and other metals being made. The prospective plan for a unit of the Associated Mines, Smelting & Reduction Co. is receiving support from a number of mining men of the district. The plans call for a 25-ton mill at a cost of $25,000. The process of this company provides for the recovery of the metals and the by-products that are generally lost in smelting operations, through a chemical separation at a relatively low cost. Should the project prove feasible, it would afford an outlet for the extensive bodies of low-grade ore as well as the large dumps of this district. The rise in copper is encouraging many producers of this district operating upon copper ores to continue. Among the leading shippers affected by the favorable copper market are, the Dora Con. company, operating through lessees, the Champion Leasing Co., operating the various levels of the Champion through lessees, and the Anvil Leasing Co., at the present time developing the Emerald Lode. The Garfield Smelting Co. has leased the Silver Lake property to J. B. Giono & Co., which is getting out ore from the main workings. No. 4 level is being operated by a force of sub-lessees. The Tip Top Leasing Co. ceased operations after working over one of the dumps of the property. Among the properties to be reopened, after lying idle for many years, are the Idaho, and the Tom Moore. The Empire State Mining & Reduction Co. is to build a mill, and no further mining operations will be carried on until it is completed. It is reported that there is a large body of good milling ore blocked out. The Mayflower Leasing Co. continues to develop its property. Heavy shipments are being made of high-grade silver concentrates. The Highland Mary Leasing Co. has sub-leased sections of the mine to various local men, and the workings are being developed extensively. It is reported that a five-foot vein of high-grade silver ore has been cut, and the outlook is favorable for heavy and continuous shipping. The Dives Leasing Co. is developing its properties extensively, and shipping in large quantities. A good vein of high-grade silver ore has been intersected. A force of 30 men is now employed, which will be increased as men are available.

SILVERTON DISTRICT, COLORADO

NEVADA

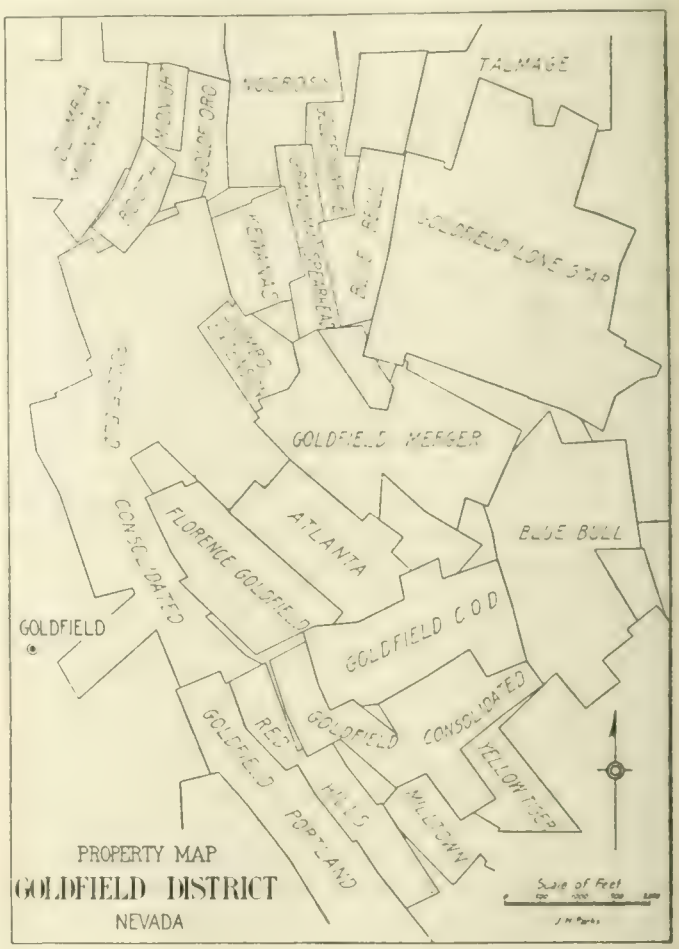
GOLDFIELD. THE ATLANTA MINE. GEOLOGY OF THE SIMON DISTRICT.

GOLDFIELD.—Mine and mill repair work has been almost stopped by the Goldfield Development Co. pending settlement of the Tonopah-Divide strike. Practically all the 125 men employed were discharged because it was feared a prolonged suspension of operations in the two

silver districts would result in financial trouble that would deplete the cash reserves of the company. The activities of labor agitators from Tonopah and Divide also was a large factor in the decision to practically suspend operations. The Florence, the only other company in the district employing a large force of men, is operating to capacity. J. B. Kendall, former manager of the Goldfield Consolidated and now manager of the Mayflower at Pioneer, has taken a lease on the Florence extending from 200 ft. north of the old Daisy lease shaft to the northern boundary of the Cornishman claim. Kendall will work through the seventh, or 358-ft. level, of the main Florence shaft in an attempt to open the intersection of the Florence-Consolidated vein and an important spur from the Jumbo vein. The Florence Divide lease on August 30 started loading the sixth car of ore since the 'high-grade' shipment.

The lower levels of the Atlanta have been abandoned following a fight with water that lasted nearly two months, and the 1800-ft. shaft of the Merger Mines Co., through which the Atlanta was working, will no longer be used in the operations of either company. The Merger shaft is the deepest in southern Nevada. Future work of the Atlanta will be from the 1465-ft. level of the Grizzly Bear shaft. Since March 14 all work in the Merger has been done through the Spearhead shaft. The reason for abandoning the lower levels was that the pumps, after years of service, were no longer capable of handling the heavy flow of water in the winze from the 1750-ft. level, through which all work was done at a depth of 1900 ft., and the cost of new machinery was considered too great. Removal of the Clermont head-frame for use at the main Development company shaft largely was responsible for recent rapid destruction of the pumps, as this permitted water containing a large percentage of sulphuric acid to flow into the Grizzly Bear shaft, from the 1465-ft. level of which the water from the Atlanta was pumped to the surface. A new head-frame has been erected at the Clermont shaft after long delay due to a shortage of suitable timber, but this was not completed and bailing resumed until the Grizzly Bear pumps had been damaged and those at the top of the winze practically put out of commission. The main winze is 1000 ft. from the Merger shaft. The water was pumped from the top of this to the shaft and from there to the 1325-ft. level of the Merger, from where it went by gravity to the 1465-ft. level of the Grizzly Bear to be pumped to the surface in one lift. Miners had not been able to reach the bottom of the winze for a month before work was abandoned. Operations to open the Atlanta vein from this winze were slow and costly. Driving in an eight-foot shoot of low-grade ore was well under way when work was stopped.

Simon District.—J. K. Turner, consulting engineer of Goldfield, recently visited the Simon district to inspect the newly erected surface equipment of the Simon Mina company, of which he is president. The shaft is now 40 ft. deep and sinking will be continued to 200 ft. before a cross-cut is driven to the vein. The Simon Mina owns five claims one mile south of the shaft of the Simon Silver-Lead company and adjoining on the east the Simon Junior. The shaft is being sunk in the same vein in which the Simon Silver-Lead orebody was opened. Other companies sinking in this vein are the Consolidated West Extension, Thompson-Walsh, Silver Top, Norman and Simon Fagan, the last two having opened ore. According to Mr. Turner, the surface conditions are similar on the claims owned by all of these companies and it is his opinion that the same general character of ore as in the Simon Silver-Lead will be found at from 250 to 400 ft. In the Simon Silver-Lead the ore is found as a contact replacement. The shoot has a width of from 25



to 50 ft. to the 200-ft. level, is 77 ft. wide on the 300-ft. level and 140 ft. wide on the 400-ft. level. The length of the shoot has not been determined. On the 300-ft. level it has been opened for 300 ft. The average content of the sulphide ore below the 300-ft. level is 8 oz. silver, 9% lead, 10% zinc, and from $1 to $3 in gold. An experimental plant for testing methods for reducing the ore is in operation at the mine.

The Simon district is in the northern part of the Cedar mountains, in Mineral and Esmeralda counties. The range is 25 miles long and rises from surrounding lake beds. The elevation is from 6000 to over 8000 ft. The district is on the west slope of the range. In a report issued on the geology of the Simon district, Mr. Turner says: "The core of the mountains is a granitic rock. The flanks are composed of Juro-Triassic lime-

stones and schistose rocks, Tertiary volcanic lake beds. The limestones and schistose rocks, shales and slates are uplifted, intruded, folded, fissured, and fractured by igneous rocks (granites, grano-diorites, and diabase) and partly covered toward the north end of the range by flows and intrusions of Tertiary volcanics (rhyolites, andesites, and basalt). The mineralization of the Simon district is extensive and outcrops of gold, copper, and lead ores are frequent. Oxidation and the action of surface water have greatly leached or altered the surface of the veins to such an extent that little of the metallic content remains, necessitating sinking to the unleached part, which is usually found at from 250 to 400 ft. Contact veins are frequent and the silver-lead veins largely follow the contacts between limestone and the intrusive igneous rocks. Many cross-fissures radiate from the contacts, containing good ore. The mineralized area extends far into the limestone."

WISCONSIN

PLANT OF THE NATIONAL ZINC SEPARATING CO.

CUBA CITY.—The National Zinc Separating Co. has a capacity of 275 tons of crude zinc concentrate per 24 hours. The plant uses a Wedge furnace and treats a variously composed ore running from about 23 to 46% zinc. The ore supply comes mainly from a string of producers operated by the Vinegar Hill Zinc Co., supplemented by purchases made in the open market from nearby low-grade producers. The ore is introduced into bins and distributed into a Wedge furnace which has seven roasting hearths and a top drying hearth, 22 ft. 6 in. diameter and 24 ft. above the floor. The roasted ore is discharged from the lowest hearth into two rotary coolers. No outside fuel is necessary in roasting the ore. The dust-laden gases, passing out through the side of the furnace from the first hearth, are first led into a dust-chamber, then through a Cottrell precipitator, and are then discharged to the air through a stack 6 ft. in diameter and 170 ft. high. The Cottrell precipitator consists of two units which are so arranged that either unit may be operated alone or in parallel with the other. At present each unit is operated separately and alternately for periods of about two weeks. From the Wedge furnace the ore passes through four rotary drums water cooled by means of a spray directly above them. The temperature is reduced appreciably but the ore is far from cold when it reaches the magnetic separators. Two types of Dings separator are employed, the M. M. rougher and the H. I. machine. The ore as delivered to the finishing machine will average 56 to 58% Zn and 3 to 4 % Fe. The finisher magnetic separator is made by the Dings Electro-Magnetic Separator Co. of Milwaukee. In its final stages the ore is brought up to premium grade, frequently assaying as high as 63% zinc. The power is furnished by the Interstate Light & Power Co. of Galena, Illinois, fourteen miles from Cuba City. It is transmitted to the National plant from the Cuba City substation and from there is transformed to 220 volts. The power consumption per 24 hours required for the treatment of 125 tons of ore per day amounts to 2950 kilowatt-hours. The total cost of green ore roasted based on a tonnage of 125 tons per 24 hours is about $3 per ton. The advisability of a thorough cleaning of concentrates is evident in a field where the zinc-blende occurs intimately associated with iron sulphide in the form of marcasite. With the ordinary methods of concentration obtaining in the Wisconsin field it is impossible to obtain a clean concentration. In fact so irregular do the assays appear that it may be stated that no two mines in the field show the same concentrate assay. Making a high-grade concentrate affords two distinct advantages: first, a marketable commodity commanding a higher price; second, a reduction of freight rates by the elimination of non-essential material.

Most of the roasting and magnetic separating conducted in the Wisconsin zinc-lead camps is done by three companies: the Mineral Point Zinc Co. at Mineral Point, National Separators at Cuba City, and Wisconsin Zinc Co. at New Diggings. There are, however, other and smaller concerns engaged in roasting ores. The Linden Zinc Co. has a small plant at Cuba City; the Block-House Mining Co. has installed an independent unit at Platteville in connection with its surface rig; and there are independent plants at Benton and Linden, both of which have been idle for two years. The Galena-Joplin plant at Galena, Illinois, resumed active work recently after a protracted period of idleness, but its capacity is limited. A return to normal conditions throughout the country, accompanied by a more stable condition in zinc mining, will no doubt witness greater development of the separating branch of zinc concentration.

BRITISH COLUMBIA

CARIBOO DISTRICT. GENERAL NEWS.—A NEW DEVELOPMENT SYNDICATE.

Monthly returns of the gold bullion received at the Dominion Government Assay Office at Vancouver indicate that the output of British Columbia and the Yukon this year is not likely to exceed greatly that of the last twelve months, although an encouraging upward tendency in production is noted. A substantial increase is predicted in 1920 when new properties such as those being developed on Sheep creek begin shipping, when placer ground which has been dormant during the War is made productive, and when the dredging companies, several of which are commencing operations in the Cariboo, are operating. The value of gold bullion received at the Vancouver office from British Columbia last year was $2,178,078 and from the Yukon territory, $1,921,197. This, of course, does not represent all the gold produced by these parts of Canada.

Honorable William Sloan, Minister of Mines, has just returned after a trip through the Cariboo district. The object of his tour was to discuss with the miners and prospectors the question of dredging and placer licenses, to the end that the Government might ascertain what is necessary to encourage the opening of that region. Mr. Sloan is of the opinion that large areas that have been

held for many years without development should be made productive. He found much interest manifested in gold mining throughout the district and believes that although the output recently has not been so large as in the past it will increase in the future. With the Pacific Great Eastern Railway, which now is being constructed through the Cariboo to Fort George, and which eventually will tap the great Peace River country, furnishing transportation facilities, operators will be able to place heavy mining machinery on their property. The Minister of Mines pointed to the fact that men with large experience at dredging operations in the Yukon are going into the Cariboo and investing heavily, and considered that as being encouraging to the latter district. An instance was that of James Moore, one of the large operators of the Yukon, who is placing a dredge on Antler creek. His associates have secured a large tract with promising placer grounds on the Swift and Little Swift rivers, and preliminary investigations have so satisfied them that they have arranged to install a large dipper dredge. Mr. Sloan also spoke of the activity of the Dominion government in conducting a geological and topographical survey covering 16 square miles of that section. This work is centred at Harpers Camp where there is some promising ground. At present the International Dredging Co. has a machine operating with good results. At the junction of the North and South forks of Horsey river a drag-line scraper is being put in by Victoria mining people and the experiment is being watched with interest.

YALE, B. C.

LARDEAU.—The same evidence of revival in mining is found in the Lardeau district as in the Kootenay and Boundary districts. The New Era Mining Co., of Vancouver, proposes placing the old Beatrice mine, near Camborne, on the shipping list. This property was shut down some years ago because of the low price of silver. It is on the summit of Lexington mountain, near the headwaters of Mohawk creek. The Gold Bug-Rambler mine is reported to be showing up well under development. A discovery just announced is described as consisting of 25 ft. of concentrating ore with 18 in. of clean ore on the wall, running high in silver with 55 to 60% lead and some gray copper. The property is on the south fork of Lardeau creek, seven miles from Trout Lake City. Some fine samples of clean galena have been taken from the Tenderfoot group on Tenderfoot creek. There are three parallel veins on this property which have been developed by about 200 ft. of tunnels, the greatest depth being about 50 feet.

ROSSLAND.—Residents of Rossland are confident that the large concentrator which the Canadian Consolidated Mining & Smelting Co. will provide for the treatment of the ores of the Rossland district will be placed in that city rather than at Trail. Surveys now are in progress and investigation under way as to the water supply. It is thought that no difficulty will be experienced in meeting the requirement in respect to the latter. In the meantime Rossland, once the busiest mining centre of the Province but recently suffering through the comparative inactivity of the mines on which the community chiefly depends, has taken on a new lease of life and is looking confidently to the future.

KIMBERLEY.—A forest fire swept away most of the equipment of the North Star mine, a well-known silver-

lead property which has been producing for some time. The tram line, some buildings, and necessary plant were destroyed. This is being replaced as rapidly as the material can be secured and the mine will be shipping again in a few weeks.

Slocan City.—The Evening Star and Silver Nugget mines, which have been dormant for years, are to be operated again. William Moore, owner of the California mine, is supervising the work. Cars, rails, and other mining supplies have been forwarded through Nelson. The Evening Star is situated on Dayton creek about seven miles from Slocan City. Considerable development has been done on the property and plans have been decided upon for continuing it. The Silver Nugget is situated about six miles from Silverton. This also has been opened up to the extent of driving two tunnels. A shipment of ore from the Evening Star two years ago ran 347 oz. of silver and $23 in gold per ton, and in 1894 a shipment from the Silver Nugget gave a return of $208 per ton, silver then being 57 cents.

Vancouver.—An organization known as the Vancouver Mining Development Syndicate has been launched with a capitalization of half a million dollars and $100,000 capital subscribed. The object of this Syndicate is to bring mining prospects of British Columbia to the attention of the investing public. The idea is that in the event of a prospector locating a promising property which he lacks means of developing he can go to the Syndicate for assistance. The latter then will send a competent engineer to report and, if the report is favorable, the prospector will be given financial aid. Should the proposition look as well on development as it originally promised it will be placed on the market, a portion of what is realized to go to the discoverer and a portion to the Syndicate. Nicol Thompson, A. M. Whiteside, J. H. Greer, A. H. Wallbridge, and A. Erskine Smith are members of the board of the new organization. They are businessmen of the city of Vancouver.

ONTARIO

THE STRIKE SITUATION.—RECENT DEVELOPMENTS IN THE PROVINCE.

Mining operations in the Kirkland Lake and Cobalt camps remain completely suspended owing to the strike, which shows no signs of reaching a settlement. At Cobalt during the past week there was a strong attempt made by a committee of returned soldiers employed in the mines to bring about an understanding between the parties but without result, as neither the managers nor the strikers appeared disposed to make concessions. At last accounts the situation had reached a deadlock, the managers insisting on the men returning to work before any settlement of the questions at issue was considered, and the union leaders expressing their determination to continue the fight until spring if necessary.

Porcupine.—Official figures for the first 24 weeks of the current year show that the Hollinger Consolidated treated 316,386 tons of ore, with a total output of $3,166,625, a yield per ton of $9.93. The cost per ton was $5.20, and the total cost $1,646,868, leaving a profit of $1,519,756. The mill ran 69% of the possible running time. The company is now in a position to resume dividend payments at the former rate of 1% every four weeks, as soon as the directors consider it advisable. At the Dome Mines the mill has lately been treating ore at the rate of about 600 tons daily, the average grade of the ore being about $9 per ton. The cost of operating is understood to be in the neighborhood of $4.50. As the milling capacity is increased and the cost somewhat lessened by the treatment of a larger tonnage, the mill-heads will gradually be reduced. A resumption of dividend payments is looked for at the beginning of next year. Preliminary development on the Sovereign properties has exposed several good veins, one of which yields high assays. A shaft has been sunk 60 ft. in ore averaging $9 per ton and 5000 ft. of trenching has been done. At the Clifton driving on the Boulder vein has now extended upward of 100 ft. in ore showing visible gold. Complete assay returns for the first 30 ft. give an average of $30 per ton over a width of five feet.

Larder Lake.—The Associated Gold Fields cross-cutting on the Reddick property has cut a wide body of ore, which is believed to be a continuation of the extensive deposit on the Kerr-Addison. On the last it was 1200 ft. long and the new find may lengthen it to 2000 ft. The Crown Reserve has purchased two claims of a group owned by N. N. Maloof of Haileybury, situated a short distance north-east of the Harris-Maxwell. The purchase price is reported to be high. A recently published report by Percy E. Hopkins of the Ontario Bureau of Mines on the Larder Lake area expresses the opinion that "since the known richer shoots are small and scattered, the success of mining will depend upon the mining of extremely large bodies of low-grade ore, which will necessitate much capital and very detailed mining." This conclusion has excited much unfavorable comment on the part of mining men and prospectors, who accuse the Government geologists of knocking the area, and state that drilling to the depth of 700 ft. has shown high-grade ore.

Matachewan.—At the Matachewan (formerly the Otisse) lateral work is being carried on at the 170-ft. level and cross-cutting is also under way. Active development will be continued until winter, when an estimate can be made of the additional mining equipment required. On the Nelson claims several miles north of the centre of activity, surface outcrops show veins or mineralized dikes carrying gold contents. Test-pits are being sunk.

West Shining Tree.—There is much activity in this camp and a large amount of diamond-drill work is being undertaken. The shaft at the Wasapika is down 100 ft., and the cross-cut at 15 ft. is all in ore with visible gold showing throughout. A shaft is going down on the West Tree with visible gold across its full width. At the Atlas three test-pits on the Evelyn vein show much free gold and a working shaft is being sunk.

SUSPENSION OF ASSESSMENT WORK

We have received many inquiries about the bill for suspending annual assessment work, the text of which was published in our issue of August 23. Owners of mining claims seem uncertain whether the report of the passage of the bill was official. We have just received a bulletin of the California State Mining Bureau, stating that this bill became a law on August 15.

CALIFORNIA

Allegheny.—There is a rumor current here that the famous Tightner mine is to be sold to a party of New York capitalists. It is understood that the price is more than $2000 per share, which would make the purchase price in the vicinity of a quarter of a million dollars.

Grass Valley.—The hoist at the Union Hill mine is being dismantled and will be erected on the old shaft of the Idaho-Maryland mine. It is stated the Union Hill will be later worked through a central shaft that the Idaho-Maryland plans to sink to facilitate economical operation of the combined properties.——Re-opening the Central Consolidated is proceeding under management of John Nichol. This property was closed at the outbreak of the War and has been idle ever since. Some difficulty is being experienced in securing miners. Dewatering of the shaft is in progress. The company is controlled largely by Honolulu capital.

Heroult.—The Noble Electric Steel Co. is shipping a carload of iron ore weekly to San Francisco foundries, where it is converted into pigs by the open-hearth process. Development of the deposit is proceeding, but no attempt is made to operate the electric steel smelter.

Igo.—A temporary injunction issued from the Superior Court restrains C. C. McDonald, V. V. Apperson, and S. Jamerson from shipping ore they have extracted from the South Fork mines until after the suit brought by Mrs. Mary Ballou is tried. Mrs. Ballou claims that the South Fork mines are hers.

Ingot.—The Afterthought Copper Co.'s new reverberatory furnace is in operation, and the oil-flotation plant will be started soon. The company has been having trouble obtaining a full crew of men.

Knob.—The Gibson mills are running on ore from the Midas and Bull Moose mines, controlled by the Victor Power & Development Co. Development of the Bull Moose has uncovered high-grade gold ore and a fair tonnage is exposed.

La Porte.—Prospecting old river channels nine miles north of La Porte is being carried on by three companies by means of Keystone drills. It is reported results have been encouraging, and long-sought deposits have been found. The South Fork Gold Gravel Co. reports that a channel 1500 ft. wide has been indicated by the drills, and preparations are being made for mining. Robert Edgar is superintendent. Head offices are at Lindsay, California.

Lewiston.—The Bablew hydraulic mine has closed down for the season, on account of a shortage of water.

Nevada County.—The Golden Center mine will close temporarily about September 1, because of a heavy flow of water that flooded the present pumping plant. A heavier plant will be installed.

Sierra City.—The Hilda Gold Mining Co., the Yuba River Mining Co., and the Primrose Gold Mining Co. have recently been re-financed by C. P. Doelger, A. B. Matzene, L. J. Baumer, and several other prominent business men of New York. The several channel claims on the Yuba river belonging to the first two companies and the promising 12-ft. quartz vein of the Primrose mine will be fully developed. Recent work on the Primrose shows an excellent vein running $15 per ton. Samuel H. Dolbear has been appointed general superintendent of all operations, and J. R. Evans, superintendent of the Primrose property.

Sierra County.—The U. S. District Court at San Francisco last week denied the injunction asked for by the Twenty One Mining Co. against the Sixteen to One Mining Co. involving vein rights to valuable mining ground at Alleghany. It was stipulated that the question at issue should go to the Supreme Court at Washington for final determination.——H. J. Sheafe, field geologist for the War Minerals Relief Commission, is making examinations and reporting on the chrome ore mined last year in connection with the claims of several applicants. Later he will pass upon deposits mined in Nevada county.

COLORADO

Cripple Creek.—Good ore at depth has again been intersected on the Lee 5 vein of the Portland company on Battle mountain. Driving south on the vein at the Roosevelt Tunnel level, 2131 ft. below the collar of No. 2 shaft, a rich shoot was cut, the ore breaking from four to five feet wide, with a core from one to three inches of sylvanite. The Portland shaft has been sunk 150 ft. below the tunnel level, a total depth from surface of approximately 3000 ft. A station is now being cut at this depth.——The El Paso Extension Gold Mining Co., having acquired control of the Lexington Gold Mining Co., will install machinery at the Clara D shaft on Gold hill. An electric hoist is planned for the Jeff Davis if lessees are secured for that property. Lessees on the Clara D are mining and shipping a good milling grade of ore. The dump has also been leased.——The Forest Queen Mines Co., operating the Forest Queen on Ironclad hill, has resumed production. A car of between $30 and $40 ore was consigned to the Golden Cycle mill last week.——Operations will be resumed by lessees on the Mary Cashen Mining Co.'s property at Victor, on or about September 1.——The property adjoining the Strong mine and Portland and Granite companies' estates has been closed down for a long period. The mine has produced a fair tonnage of low-grade ores, which, under the lower treatment rate now obtaining, may be mined at profit.——Reports from the Cresson mine are to the effect that the August production will show an increase. The directors of the company will soon meet in Colorado Springs, when it is expected the monthly dividend of 10c. per share, a total of $122,000, will be declared.——The Golden Cycle Mining & Reduction Co. will pay on September 10 the regular monthly dividend of three cents per share, a total of $45,000, to stockholders of record of August 31.

IDAHO

Coeur d'Alene.—Electricity will be used to operate a compressor which the Sterling Silver Mountain Mining & Milling Co. plans to install for the development of its property on Big creek. New buildings for machinery and men will be erected. One vein on this property has a width of 20 ft. on the surface. A lower cross-cut tunnel is expected to reach this vein at a distance of 500 ft. and a depth of 500 ft. A second vein lies beyond. A carload of ore, the first taken from the shoot struck recently on the 500-ft. level, has been shipped by the Richmond Mining, Milling & Reduction Co. It contained 40 tons and included chunks of sulphide ore having an estimated content of 30 to 35%. Shipments will be made more frequently when the stope has been opened sufficiently for production.——Adjustment is proceeding at the concentrating mill of the Nabob Consolidated Mining Co., on Pine creek. Ore is being dressed in the period of adjustment and concentrate is being produced, although in less volume than anticipated when the adjustment has been completed. The tonnage available for milling is being increased daily.

Mullan.—The Copper King Mining & Smelting Co. has cut a vein 50 ft. wide on its tunnel level. The vein so far as it has been explored does not contain ore in commercial quantities, but galena and bunches of lead are found at intervals.

Southern Idaho.—F. A. Thomson, dean of the school of mines in the University of Idaho, has concluded a tour of all the mining districts in southern Idaho. "Interest in mining is being re-awakened in southern Idaho," says Professor Thomson. "The Delamar and Trade Dollar mines have been re-opened, and there is much activity in districts that have been quiet for a long time."

Ten Mile.—Recent development at the property of the Summit Flat Mining company has given encouraging results. A vein 35 ft. wide has been intersected by a cross-cut tunnel at a point 1100 ft. from the portal and at a depth of 225 ft. Drifts have been driven for short distances in both directions on the vein, disclosing an orebody of good size. Sampling encourages belief that at least $20 in gold and silver to the ton may be expected from parts of the vein having a total width of 10 ft. Operations are in progress on 11 properties in the field, according to a letter from Ralston McCraig, secretary-treasurer, who is directing operations on the Summit Flat. The properties are the New York, McKay, South Fork, Buckhorn, International, Mineral Zone, Gilt Edge, Una, Homestake, Frank Peck, and Biack Pine.

MICHIGAN

Houghton.—The Calumet & Hecla reclamation plant at Lake Linden now is recovering more copper than at any time in its history and is making a larger gross profit per ton of material handled than any mine operated by the Calumet & Hecla.——The additional flotation plant will be ready to operate September 1. It has a number of alterations intended to bring about greater economy in operation, the result of the lessons learned in the operation of the original plant.——The first cargo of Belgian flint bricks has arrived and the Hardinge regrinding mills now are being lined with them. The conclusion of peace makes the importation of these bricks again possible.——Franklin continues sinking. The shaft is now 3900 ft. deep and a station is being cut. The shaft is in the foot-wall of the Pewabic amygdaloid. The mineralized portion of this amygdaloid may be cut by a cross-cut to the west. The Allouez conglomerate is approximately 420 ft. to the east and may be cut by cross-cutting, so that the objective of the present shaft operations is the development, with depth, of these two formations. There will be no 38th level. Whether the 39th will be opened by laterals has not yet been determined. No plans have been made to resume production, but the conditions at the mine and at the mill are such that resumption may be brought about in a very short period of time. There is no production of copper at the present time, the only rock that is going to surface coming from the shaft sinking, which is in the foot-wall trap.

NEVADA

Austin.—The caved section of the Hiawatha tunnel has been repaired by the Austin Nevada Consolidated. The tunnel is advancing to strike the vein at a depth of 140 ft. H. G. Richardson is manager.——International Victory Mining Co. has resumed operations at its Birch Creek property and acquired the Eastern Star, Polar Star, and North Star claims from Frank Cochran and W. A. K. Robertson. Two veins traverse the claims, and a shaft will be sunk on the Eastern Star to open an orebody that shows five feet of milling ore on surface.

Goldfield.—It has been announced that the property of Le Champ-D'or French Gold Mining Co., Ltd., has been taken over by the Mt. Vernon Mining & Milling Co., a Nevada corporation. The property, consisting of 17 mining claims, is 30 miles south of Goldfield in Esmeralda county, and within nine miles of the Tonopah and Tidewater railroad. Plans are being made to build a mill and start development. G. A. Bice is president and S. O. Trescott is secretary.——The output of the Florence mine in the past 30 days approximated $109,430, according to an estimate by E. A. Byler, consulting engineer. This includes $98,000 from the Florence Divide lease; $10,000 from the Giles lease, and $1200 from the Arnold lease. Several applications for leases have been received and are under consideration by the management.——The Silver Glance Mining Co. has been incorporated to operate four claims at Coaldale. Ore containing gold and silver is exposed and several shipments have been made. Louis Sigmund is president, and M. Sigmund secretary-treasurer.——Washington Gold Quartz Mining Co. has arranged for resumption of work at the Randolph group, nine miles from Bonnie Clare, with J. K. Turner manager. Development includes a 410-ft. shaft and an adit 726 ft. long. Two veins have been developed, with the ore sampling from $15 to $40 per ton. The ore is principally lead carbonate and lead sulphide, with some gold and silver occurring. The main vein ranges from 5 to 15 ft. wide.

Loring.—Ex-Congressman E. E. Roberts of Reno, and W. I. Beauchamp of Loring, have purchased control of the Sheepherder's Dream property and arranged for immediate erection of a 50-ton mill. This was the first property on which rich ore was found in the district. Roberts also controls the New Willard Metal Mines Co. This camp was formerly known as Willard, but the name was lately changed to Loring in honor of W. J. Loring, the Californian mining engineer.

Mina.—Work in driving and cross-cutting at the Simon Silver Lead is progressing rapidly with favorable results. ——The Simon Fagan mine, under the management of E. S. Chafey, is making encouraging progress. The vein is widening and the grade of the ore seems better.——On the Pierce-Likens property, about 1½ miles from the Simon Fagan, a strike of $50 ore is reported, only 10 ft. from the surface.——Al Annett of the Norman Silver Mines Co. reports that the new hoist is very nearly ready for operation, and that the mine looks better than ever.——The Consolidated West Extension is pushing the cross-cut on the 110-ft. level, and the formation warrants a most hopeful outlook for the near future.——The Simon Junior is being developed under the superintendence of R. G. McDonald.

The main tunnel is in about 100 ft. and recently cut through the calcite vein, and it is expected it will shortly reach the rhyolite and calcite contact where the ore is expected to be found.

Rosebud.—Four feet of ore sampling 300 oz. of silver has been uncovered by the Church lease near the Dreamland mine, in the north end of the camp. The ore was found near the surface. A few years ago Rosebud attracted much attention as a result of rich discoveries but the limited development failed to uncover persistent orebodies. The district is five miles from Sulphur, a station on the Western Pacific.

Unionville.—Ore running high in tungsten has been discovered in the Arizona mine, operated by the Sunset Mining & Development Co. Three teams are hauling concentrates containing tungsten, silver, and gold to Mill City, for shipment to Utah smelters. The mill is running steadily and late developments have been satisfactory. The property is one of the oldest silver producers in Nevada.

UTAH

Marysvale.—Operations at the Bully Boy mill on the old Webster mine in Pine canyon, after four years of inactivity, have been resumed. Recently Michael Barnett, agent of the Bully Boy company, arrived here from Pittsburgh, and a force of men was put to work opening up old stopes. The Veteran Mining Co. is driving a tunnel on the Great Western vein with the idea of getting under the orebodies. Recently a shipment of oxide ore that netted $40 per ton in gold and silver was made from the old Deseret mine. This mine, which is the property of the Elias Morris estate of Salt Lake City, was re-opened a few weeks ago by Joseph Moss and Charles Carlson of Salt Lake City. The mine is reported to be in excellent condition.

Tintic.—Ore shipments from Tintic for the week ending August 29 amounted to 126 carloads, which is 11 carloads less than shipments a week ago, when the toltal was 137. The shippers follow:

	Cars
Chief Consolidated	30
Dragon Consolidated	23
Iron Blossom	17
Tintic Standard	16
Mammoth	10
Eagle & Blue Bell	8
Colorado Consolidated	6
Swansea	4
Ridge & Valley	3
Empire Mines	2
Gemini	2
Alaska	1
Sunbeam	1
Grand Central	1
Victoria	1
Utah Consolidated	1
Total	126

Theodore Nichols of the Tintic Empire Mining Co. reports that a force of men is at work breaking ground preparatory to installing the head-frame for sinking a shaft midway between that of the Paymaster and the proposed shaft of the Lehi Tintic. It is stated that a contract has been let for a bunk-house, boarding-house, and blacksmith-shop, and the buildings will be in course of erection this week.

BRITISH COLUMBIA

Camborne.—R. R. Christie, of the New Era Mining Co., bondholders of the Beatrice mine, left Vancouver for Camborne on August 12 with a crew of men. It is the intention to re-open the Beatrice mine and keep a fair-sized crew on the ground through the winter.

PERSONAL

Note.—The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

H. W. Turner has gone to central Idaho.

Fred. G. Farish, of New York, is in San Francisco.

H. E. West has returned to Santa Barbara, where he will now reside.

H. Foster Bain visited **C. W. Purington** at Vladivostok recently and is now at Peking.

Robert A. Schmucker has returned from New York to the Braden Copper Co., at Rancagua, Chile.

C. M. Weld has returned from war work at Washington to his consulting practice at New York.

H. G. Young, Lieutenant, has returned from France and is now at the Military Hospital at Quebec.

Robert S. Lewis has returned to the University of Utah, Salt Lake City, from Huntington Lake, California.

H. M. Kingsbury is returning to London from the Cape Copper Co.'s mines at Ookiep, in South-West Africa.

E. C. Bloomfield, Lieutenant in the Canadian Engineers, sailed on August 30 for the Burma Mines at Namtu.

H. D. McCaskey, of the U. S. Geological Survey, has left Washington to be stationed at Central Point, Oregon.

Jackson A. Pearce has gone to Santa Rosalia, Lower California, on metallurgical work for the Compagnie du Boleo.

Gilmour E. Brown, of Shanghai, arrived in San Francisco on the 'Empress of Asia', on his way to New York and London.

Herbert W. Gepp, general manager for the Electrolytic Zinc Co. of Australasia, passed through San Francisco on his way from Melbourne to New York.

Charles W. Wright, manager for the Pertusola Mining & Smelting Co., in Italy, has been on a visit to Marquette, Michigan. He will return to Europe early in September.

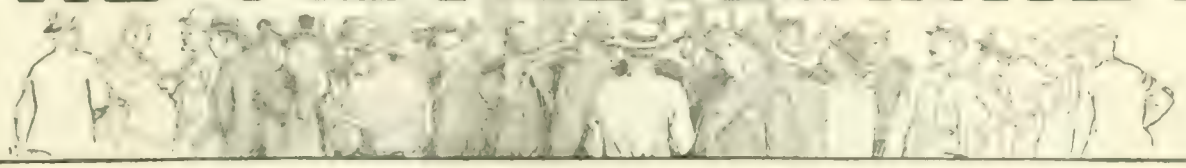
Carl H. Beal has resigned from the U. S. Bureau of Mines and has associated himself with **Robert B. Moran** as a firm of consulting geologists and engineers in the Sharon Bdg., San Francisco.

Walter Karri-Davies, who has been representing the British Provost-Marshal in San Francisco, with the rank of Colonel, has gone to Victoria, B. C., where he will remain for a time.

Henry Clay Callahan died at Los Altos, California, on August 30, at the age of 66. We deeply regret to record the fact. Further notice will appear in our next issue.

Frank W. Oldfield died in England on August 26. He had been suffering from Bright's disease for several years, while manfully attending to his duties as manager for the Cinco Minas Co. in Jalisco, Mexico. He graduated from the Royal School of Mines, London, in 1901 and obtained his first important appointment in 1903 as superintendent of the Zaruma mines, in Ecuador, remaining there four years. Between 1910 and 1913 he was manager for the Mexican Mines Co., in Mexico, and in 1913 he was placed in charge of the Cinco Minas, which prospered greatly, even during the revolutionary troubles, while under his management. He showed unusual tact and unflinching courage in his attitude toward the various groups of bandits that made depredations on the little community under his supervision, but the anxieties incidental to these experiences served to aggravate the disease to which he finally succumbed. A clever technician, a capable manager, an honorable engineer, and a faithful friend, his untimely death will be deeply regretted by many in Mexico, the United States, and England.

THE METAL MARKET



METAL PRICES

San Francisco, September 2

Aluminum dust, cents per pound	50—60
Antimony, cents per pound	10.50
Copper, electrolytic, cents per pound	21.00
Lead, pig, cents per pound	6.25—7.25
Platinum, pure, per ounce	$105
Platinum, 10% iridium, per ounce	$121
Quicksilver, per flask of 75 lb	$95
Spelter, cents per pound	9.50
Zinc dust, cents per pound	11.00—13.50

EASTERN METAL MARKET

(By wire from New York)

Sept. 2.—Copper is quiet and easy. Lead is inactive but steady. Zinc is dull and lower.

SILVER

Below are given official or ticker quotations in cents per ounce of silver 999 fine. From April 23, 1918, the United States government paid $1 per ounce for all silver purchased by it, fixing a maximum of $1.01½ on August 15, 1918, and will continue to pay $1 until the quantity specified under the Act is purchased, probably extending over several years. On May 5, 1919, all restrictions on the metal were removed, resulting in fluctuations. During the restricted period, the British government fixed the maximum price five times, the last being on March 25, 1919, on account of the low rate of sterling exchange, but removed all restrictions on May 10. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the normal rate of exchange.

Date	New York, cents	London, pence	Average week ending	Cents	Pence
Aug. 27	114.00		July 22	104.85	54.25
" 28	115.25	58.75	" 29	106.54	54.90
" 29	111.00	58.00	Aug. 5	108.08	55.17
" 30	108.50	58.00	" 12	110.58	58.02
" 31 Sunday			" 19	112.68	59.14
Sept. 1 Holiday			" 26	112.00	60.66
" 2	108.50	61.00	Sept. 2	111.45	58.93

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	75.14	88.72	101.12	July	78.92	99.62	106.36
Feb.	77.54	85.79	101.12	Aug.	85.40	100.31	111.35
Mch.	74.13	88.11	101.12	Sept.	100.73	101.12	....
Apr.	72.51	95.35	101.12	Oct.	87.38	101.12	....
May	74.61	99.50	107.23	Nov.	85.97	101.12	....
June	76.44	99.50	110.50	Dec.	85.97	101.12	....

COPPER

Prices of electrolytic in New York, in cents per pound.

Date		Average week ending	
Aug.	27	July 22	21.50
"	28	" 29	23.50
"	29	Aug. 5	22.87
"	30	" 12	22.20
"	31 Sunday	" 19	22.33
Sept.	1 Holiday	" 26	22.83
"	2	Sept. 2	22.55

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	29.53	23.50	20.43	July	29.67	26.00	20.82
Feb.	34.57	23.50	17.34	Aug.	27.42	26.00	22.51
Mch.	36.00	23.50	15.05	Sept.	25.11	26.00	....
Apr.	33.16	23.50	15.23	Oct.	23.50	26.00	....
May	31.69	23.50	15.91	Nov.	23.50	26.00	....
June	32.57	23.50	17.53	Dec.	23.50	26.00	....

LEAD

Lead is quoted in cents per pound, New York delivery.

Date		Average week ending	
Aug.	27	July 22	5.62
"	28	" 29	5.91
"	29	Aug. 5	5.87
"	30	" 12	5.64
"	31 Sunday	" 19	5.68
Sept.	1 Holiday	" 26	5.88
"	2	Sept. 2	5.90

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	7.64	6.85	5.60	July	10.93	8.03	5.53
Feb.	9.10	7.07	5.13	Aug.	10.75	8.05	5.78
Mch.	10.07	7.26	5.24	Sept.	9.07	8.05	...
Apr.	9.38	6.99	5.05	Oct.	6.97	8.05	....
May	10.29	6.88	5.04	Nov.	6.38	8.05	....
June	11.74	7.59	5.32	Dec.	6.49	6.90	....

TIN

Prices in New York, in cents per pound:

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	44.10	85.13	71.50	July	62.60	93.00	70.11
Feb.	51.47	85.00	72.44	Aug.	62.53	91.33	....
Mch.	54.27	87.00	72.50	Sept.	61.54	80.40	....
Apr.	55.63	88.53	72.50	Oct.	62.24	78.82	....
May	63.21	100.01	72.50	Nov.	74.18	73.67	....
June	61.93	91.00	71.83	Dec.	85.00	71.52	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound.

Date		Average week ending	
Aug.	27	July 22	8.17
"	28	" 29	8.32
"	29	Aug. 5	7.94
"	30	" 12	7.64
"	31 Sunday	" 19	7.86
Sept.	1 Holiday	" 26	8.00
"	2	Sept. 2	7.89

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	9.75	7.78	7.44	July	8.98	8.72	7.78
Feb.	10.45	7.97	6.71	Aug.	8.58	8.78	7.81
Mch.	10.78	7.67	6.53	Sept.	8.43	9.05	....
Apr.	10.20	7.04	6.49	Oct.	8.32	9.11	....
May	9.41	7.92	6.43	Nov.	7.76	8.75	....
June	9.63	7.92	6.91	Dec.	7.84	8.49	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. Prices, in dollars per flask of 75 pounds:

Date		Date	
Aug.	5 105.00	Aug.	19 105.00
"	12 105.00	"	26 100.00
		Sept.	2 95.00

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	81.00	128.06	103.75	July	102.00	120.00	100.00
Feb.	126.25	118.00	90.00	Aug.	115.00	120.00	103.00
Mch.	113.75	112.00	72.80	Sept.	112.00	120.00	....
Apr.	114.50	115.00	73.12	Oct.	102.00	120.00	....
May	104.00	110.00	84.80	Nov.	102.50	120.00	....
June	85.50	112.00	94.40	Dec.	117.42	115.00	....

FOREIGN EXCHANGE

Foreign exchange was generally steadier during the week, particularly sterling. It is probable that the break the week previous on the Lloyd George speech left a much smaller total of bills hanging over the market, and the recovery reflects considerable short covering as well as the effect of selling foreign-held securities in New York, and the accumulation by Americans of funds abroad at low rates. Continental exchanges continue noticeably weaker than sterling, although following the latter's lead of less violent fluctuations. For the purpose of helping trade relations between the United States and Italy, a credit concern with $100,000,000 capital, of which American bankers will take one-half and Italians the balance, is being formed. The Italian government will be asked to guarantee a return on the stock at either 5% or 7% and to guarantee credits up to $500,000,000, which the company will be prepared to extend. It is understood the Italian government has informally agreed to at least a part of the guarantee. The plan calls for the deposit by the Italian government of its bonds at 50 cents on the dollar. Should the credit organization be perfected as now planned, two others will probably be formed, each with similar capital, for handling British and French business. If it should be found necessary the proposed new Italian concern will buy ships, but it is believed, there will be sufficient bottoms available for its purposes. Little definite progress, however, apparently is being made in the matter of wholesale financing of credits to Europe; the questions of the Administration's attitude, of co-operation by the general business world, of the status of the domestic investment market, and of the interest rate, are still in flux. Meanwhile there is reported a considerable flow of money to Germany at the bargain rate of slightly less than a nickel for the mark, by Americans who bought German goods before the War and by those wishing to remit to relatives in Germany and Austria.

A reflection of the current exchange position is observed in the marketing here of considerable quantities of American railway bonds held in allied countries, the discounts of 15% and 36% on English and French currency, even at bid prices several points under the current market for these securities, constituting a strong incentive. Thus the movement of securities this way helps in a small way to offset the flow of goods outward. The real relief force, however, must be on a vastly larger scale, in the form of credits. As to this a lead is still awaited from Washington, which in turn stresses the need of first passing the treaty.

Gold. Gold holdings of the United States, including coin and bullion in Treasury, fell off $105,529,358 during July to $2,989,548,109 on August 1, the smallest holdings since March 1917, when they stood at $2,968,355,434. On April 1, 1917, gold holdings first crossed three billion, being $3,088,904,808, and August 1, 1919, for the first time since our entrance in the War, they fell below three billion. From 1915 until April 1917 gold holdings increased about $1,000,000,000, as Europe shipped gold to pay for war supplies and sustain her credit. When we entered the War gold imports fell to a minimum, as the United States Treasury advanced billions of dollars in credits to our allies. An interesting feature of our recent moderate but steady exports of gold is the wide geographical distribution which these shipments are taking. Among the most recent recipients are Venezuela, Guatemala, Switzerland, Japan, and China.

Quotations on September 2 are as follows:

Sterling:	Cable	4.81
	Demand	4.80
Francs:	Cable	8.10
	Demand	8.11
Lire:	Demand	9.60
Marks		5.00

Eastern Metal Market

New York, August 27.

All the markets have again turned quiet, but prices in most cases are firm.

Outside copper quotations are at least 1c. under those of leading producers and sales have been made at both levels.

The tin market is uneventful. Arrivals are large and spot Straits is easier.

The lead market is quiet but strong with sales moderate.

Demand for zinc is light and trade is at a standstill. What is being done is largely by second hands who are trading in bills of lading.

Antimony is quiet and unchanged.

IRON AND STEEL

The opinion of the steel trade that the strength of the strike movement, engineered by the American Federation of Labor, has been greatly overstated is unchanged in view of last week's development, says 'The Iron Age'. The President's stand against a sweeping railroad wage advance has not helped the steel strike drive. The large majority of mill workers are opposed to being thrown out of employment. Neither manufacturers nor consumers of steel are apparently taking steps to stock up in anticipation of a strike. Export trade is still expanding, with the Orient, South America, and neutral countries good buyers. One large steel export company reports its August business the best of the year.

COPPER

There are virtually two copper markets and quotations depend on which one is taken. Virtually all the producers of electrolytic will take no business at less than 23.50c., New York, for August-September delivery or 24c., New York, for October. Some business has been done at these prices. From outside dealers and second hands, however, this grade of copper can be obtained as low as 22 to 22.25c., New York, for early delivery, at which level some business has been done. Some contend that a substantial amount is obtainable in the outside market while others claim that this metal has been pretty well disposed of. In the absence of any definite proof we quote the market at 22.25c., New York, for electrolytic copper for early delivery. Lake copper is closely held at 23.50 to 24c., New York, for early delivery by all producers. Whether obtainable from second hands at lower prices it has not been possible to determine. Because of the unusual conditions prevailing in the exchange markets, foreign inquiry has not developed as it is expected it will later. Demand from domestic consumers is light and although the market is generally quiet, the tone is strong.

TIN

The feature of the market is the free arrivals of tin, which have been large this month. Thus far these have amounted to 4055 tons, with 4090 tons reported afloat. Of the total arrivals, 2805 tons has come in at Atlantic ports. Because of this the price of spot Straits tin has softened slightly to 56c., New York, at which level some business is reported. Early last week an active business was done in future shipments from the Straits, but since then demand has fallen off and this phase of the market is quiet. Closing prices yesterday for future shipment were as follows: September shipment from the Straits, 52.50c., with October shipment at 52.25c.; Lamb & Flagg, prompt shipment from England, 52.25c., with prompt Straits from England at 53 to 53.25 cents.

LEAD

The outside market is still getting stronger and gradually approaching that of the leading interest, but as it comes nearer to the latter the upward movement is slower. The quotation of the American Smelting & Refining Co. continues unchanged at 6c., New York, or 5.75c., St. Louis; that of the outside market is 5.90 to 5.95c., New York, or 5.75c., St. Louis. There is not much activity but the tone is firm. One seller reports sales of at least 1000 tons at 5.95 to 6.05c., New York, in the last week.

ZINC

The market is lifeless. Producers contend that at present levels there is no profit and refuse to be interested except to buyers willing to pay higher than 7.60c., St. Louis, or 7.95c., New York, which seems to be the nominal market. Some producers say their price is 8c., St. Louis, or 8.35c., New York. There is no demand and hence no market. The general concensus of opinion is that 7.60c., St. Louis, or 7.95c., New York, is a fair quotation. It is stated that most of the trading being done is in bills of lading which are being freely handed around by outside interests and speculators. Demand from galvanizers is light because of the possibility of a strike in the steel industry, and brass makers are now in no need of zinc. Ore prices are again high. The fact that natural gas interests are attempting to double rates for the second time is a disturbing factor in some producing sections.

ANTIMONY

There is but little change. Wholesale lots for early delivery are still quoted at 9.25 to 9.37½c., New York, duty paid, with demand light.

ALUMINUM

Quotations are unchanged at 32 to 33c., New York, for wholesale lots of virgin metal, 98 to 99% pure, for early delivery.

ORES

Tungsten: The absorbing topic has been the passage by the House of a bill placing a duty on tungsten ore and alloys. On ores $10 per unit is prescribed and on tungsten and its alloys, $1 per lb. of contained tungsten. It is too early to obtain a resumé of opinion as to the effect of this action, but to many it has come as a complete surprise and there are various opinions for and against heard here and there. Already the market is stiffening and quotations are higher on a somewhat brisker inquiry. It is too early to judge of the effect on the market. Values of ferro-tungsten have not been tested recently so far as ascertainable. It is understood that the tariff measure is to be retroactive in certain respects.

Manganese: An Eastern steel company has bought a substantial quantity of ore at 5c. per unit and has arranged with an Eastern producer to convert this into ferro-manganese.

Manganese-Iron Alloys: British quotations for ferro-manganese are as low as $100 to $105, seaboard, and it is evident that producers there are endeavoring to regain the American market which they had before the War. In 1913 they furnished 50% of the alloy consumed in the United States. That they may succeed is strengthened by the fact that the American output now is down to a pre-war basis or about 10,500 tons per month, as against one of 28,750 tons per month in 1918. Spiegeleisen is firm at $35, furnace. About 5000 tons has been sold for export in the last two or three months.

INDUSTRIAL PROGRESS

INFORMATION FURNISHED BY MANUFACTURERS

SOCIETY FOR THE PREVENTION OF CRUELTY TO MOTOR TRUCKS

Alfred F. Masury, chief engineer for the International Motor Co., manufacturer of Mack trucks, has suggested a society for the prevention of cruelty to motor trucks.

"Just because a truck can't feel is no reason why it should not be handled with care," argued Mr. Masury with sympathetic fervor for the much abused misused motor truck.

"The economy and efficiency of machinery lies in the way it is handled and treated. We need a society for the prevention of cruelty to our modern iron horses which feed on gasoline, just as we did for the old consumers of hay and grain.

"Trucks need one kind of care in hot weather and another kind in cold weather.

"Straw hats are put on horses to protect them from the excessive heat of summer; but very often drivers will forget to see that there is sufficient water in the radiator and enough oil in the oiling system to lubricate the various bearing surfaces.

"In winter horses are sheltered from the cold in stables and given an extra amount of bedding; but very often a truck will be allowed to stand over night without the water being fully drained from the radiator.

"If the horse is neglected, the animal suffers pain, and our humane societies see to it that it is stopped. But, if the truck is mistreated, it feels no pain and no one gives it any sympathy. The owner gets a severe pinch in his purse, and may hold up his right hand and swear, 'Never again'. But that is about as far as it goes. Users in general go on year after year, paying out large bills incurred through ignorance, carelessness, and indifference.

"We need a society to educate users of motor trucks to their proper care, winter and summer, and in all kinds of weather. It will mean longer life for all trucks, greater efficiency and economy, better service and greater satisfaction in every way."

ORONITE ENAMEL PAINT

Where materials and structures are exposed to severe conditions, particularly to the action of acids, acid fumes, alkalies, and salt water, protection by means of a special preservative paint is an absolute necessity. Oronite enamel paint has repeatedly proved its value as a protection against all kinds of deterioration and corrosive forces. It is unaffected by conditions which would quickly destroy materials and buildings were it not employed. On hot surfaces, such as boiler fronts and stacks, its use is invaluable. One of the largest boiler works in the North-West manufacturing steel tanks, donkey engines, and other heavy machinery, always paints its products with Oronite enamel paint before sending them out from the shops.

It is a well recognized fact that high temperatures make all kinds of metal surfaces much more easily affected by corrosive agents. Gas-making eequipment is usually subjected to very high temperatures, and it has been particularly difficult to obtain paints that would protect the metal. Oronite enamel paint has been found by a number of gas companies to give entire satisfaction, and several of them have standardized it for use throughout their plants. Engineers of gas companies have had long experience in the painting of generators, and the fact that Oronite enamel paint has been used by these engineers is sure proof of its value for this purpose.

Another use for Oronite enamel paint is in coaling stations. It was tested out recently in this connection and found to be the best preservative for all metal surfaces, including structural metal, hoists, dump cars, cranes, and buckets. Perhaps the severest service to which Oronite enamel paint can be put is in smelters and mining plants. In such places the machinery and structural steel work are subjected to acid fumes which quickly destroy all metal if it is not properly protected. Oronite enamel paint has proved a great success on smokestacks, boilers, and electrical machinery. A large mining company in Arizona is using it for insulating purposes, painting its underground motors where the water is polluted with copper, on its transmission lines, and elsewhere as an insulating coating.

These few examples of the use of Oronite enamel paint will serve to show its value under every sort of condition where protection against severe exposure is needed.

COMMERCIAL PARAGRAPHS

N. S. Braden has been appointed vice-president for **Canadian Westinghouse Co., Limited.**

Dunham, Carrigan & Hayden Co., San Francisco, have been appointed Pacific Coast distributors of the Nordstrom valve.

The Denver Engineering Works Co. has recently contracted for the exclusive manufacture and sale of commercial sizes of the Samson crusher.

Coast Equipment Co., Merchants Exchange, San Francisco, has been appointed representative for the **Atlas Car & Mfg. Co.,** for California and Nevada. All inquiries from this territory should be addressed accordingly.

Arthur B. Reynders, former Director of Production of the **Westinghouse Electric & Manufacturing Co.,** at East Pittsburgh, has recently been made works manager of its East Springfield plant. A. E. Kaiser, who has been Assistant to Director of Production since 1912, has been appointed Director of Production, to fill the vacancy made by Mr. Reynders' new appointment.

The Goodyear Tire & Rubber Co. of California, with its principal place of business in Los Angeles, has been permitted by Commissioner of Corporations E. C. Bellows to sell 60,000 shares of its preferred capital stock at par, $100, for cash, so as to net 98% of the selling price. It also is permitted to sell to Goodyear Tire & Rubber Co., of California, 30,000 shares in exchange for certain property rights, assets, and goodwill of that corporation at par for

cash. The company has an authorized capital stock of $20,000,000 divided into 200,000 shares of the par value of $100 each, 100,000 shares being preferred and 100,000 shares of common stock.

By change of name, but no change in its active organization, the **Car-Dumper & Equipment Co.** succeeds the **Wood Equipment Co.**, the new style being considered better representative of the business of this concern, whose principal item of product is rotary dumpers for mine and railroad cars. General offices are at the company's plant, 1216-1222 E. 75th St., (Grand Crossing) Chicago, Illinois.

In order to meet the large and growing need for Plymouth industrial locomotives, clay working machinery, and other Plymouth products, **The Fate-Root-Heath Co.** announces that on July 1, 1919, it succeeded to the business of the **J. D. Fate Co.** and the **Root-Heath Mfg. Co.** The consolidation greatly increases their capacity and resources and enables them to meet every demand for products of the above two companies.

The Chicago Pneumatic Tool Co. plans moving its general offices from Chicago to New York and toward this end is erecting an office building at 6-8 East 44th St. The structure is being built by the Westinghouse Church Kerr Co. of combination steel, brick, and limestone, and will comprise initially ten stories. The ground floor is to be an exhibition room and will display Chicago Pneumatic products, including Boyer pneumatic hammers, 'Little Giant' pneumatic and electric tools, rock and coal drills, 'Giant' oil and gas engines, and air compressors, some of which will be shown in operation. In conjunction, a completely equipped service station will be maintained. The operation of the company's six American plants and twenty-six sales and service branches can be directed more economically from New York. There will be continued in Chicago a sales and service organization more extensive than formerly. The new building is to be ready for occupancy early in 1920, at which time the transfer will be effected.

On January 22, 1919, the Plymouth No. 5 breaker of the Hudson Coal Co. was burned to the ground. The breaker was of wood construction throughout and the fire left it a mass of ashes and tangled junk. Before the ruins had cooled, steps were taken for its replacement. The decision reached called for an all-steel structure with concrete floors, to be roofed and sided with non-inflammable material. On February 22 the contract was awarded the **H. H. Robertson Co.** to furnish and erect all necessary roofing and siding material for the breaker and main conveyors. Black corrugated sheets 22 gauge, were selected for the roofing, and red corrugated 24-gauge sheets for the siding. On February 5 the pouring of concrete foundations began, these being completed on February 26, and on March 12 steel erection was commenced by the contractors, the Bethlehem Fabricators, Inc., this being completed April 23. The original time table, or schedule of erection, as prepared in advance by the Coal Company engineers, called for erection of roofing and siding to commence on May 10, and it was with some surprise that word was received on April 7 that the steel erection had progressed to a point where they were ready for the roofing to be shipped. Erection of roofing began on April 27, and was completed on May 5. Erection of siding sheets having to follow the work of other contractors could not progress so rapidly, but this was finished by June 5. On June 2 the machinery of the breaker was running and 300 mine cars of coal were run through. On June 6, 1800 cars, about 4000 tons, went through and the new breaker was working practically to capacity in just 130 days from the time of the fire, beating the company's best estimate by 20 days and setting a new record for construction work in the anthracite fields. In addition to the contract for the main breakers, the H. H. Robertson Co. later received the roofing and siding work for the coal and slate conveyor housings and the roofing and siding for the building being erected by the Dorr Co., to contain the coal washing and classifying machinery. Robertson black structural paint is used as a special protective coating for parts of the steel work where moisture conditions are severe, and Robertson red and black rubber coat has been applied to some older buildings, of Robertson process metal, which were untouched by the fire.

MOTOR TRUCKS IN HIGHWAY CONSTRUCTION

Good roads and the motor truck may be said to be growing up together. One is aiding in the development of the other. Modern trucks are playing a prominent part in the building and maintenance of highways throughout the country. Horse-teams have been displaced entirely by the motor truck in road construction work in most localities.

Garford 7-Ton Tractor with Dump-Type Semi-Trailer

The result has proved a saving in time, labor, and expense. The accompanying photograph shows one of the latest types of semi-trailer used in hauling crushed rock for road building. The motor truck furnishing the power is a Garford 7-ton tractor. It is predicted that the time is not far off when every community will own and operate a fleet of motor trucks and trailers in highway maintenance work.

AMONG the subjects to be discussed at the forthcoming meeting of the Institute at Chicago will be the Federal Taxation of Mines. We are glad to note that the subject will be presented by Mr. L. C. Graton, who is a member of the Valuation Section of the Internal Revenue Bureau and by his knowledge of mining affairs is peculiarly fitted to discuss the problems involved.

CANADIAN soldiers discharged prior to the signing of the Armistice, and Canadian soldiers that did not see service in France, under the original Order in Council dealing with the payment of War Service Gratuities, were not entitled to participate. We have just received a notice that under a recent Order in Council this ruling has been changed, and men who come under these classifications are now entitled to payment of the Gratuity. As a great many of these men are now resident in the United States, we publish this here to bring the matter to their attention. Soldiers entitled to the Gratuity should write to the Secretary, British Columbia Returned Soldier Commission, Victoria, B. C., enclosing a copy of their discharge certificates. Necessary application forms will then be sent.

MUCH rubbish is appearing in the daily press concerning Washington's dictum about entangling alliances and the moral to be applied therefrom to the Peace Treaty and the League of Nations. Without going into the merits of the Treaty or the Covenant, it would seem evident that a caution given a century and a half ago, even by the most farsighted of statesmen, cannot be applied with any force to present conditions. At a time when it took as long to travel by stage-coach between New York and Boston as it does now to travel between New York and London, and when messages were carried by courier instead of being telegraphed or telephoned, the prevention of entangling alliances was a relatively simple matter. Today the case is not so simple. The effect of the tremendous development of methods of communication and travel during the last half-century has been to narrow the Atlantic to a mere river; Europe is just over the horizon; the theory of avoiding entanglements by leaving other nations alone is no longer practicable. Our new neighbors are here, at our doorstep, and deal with them we must. Our isolation, which resulted from lack of means of communication, is gone for ever; entanglements, or the lack of them, depend upon the manner in which we choose to comport ourselves toward the rest of the world.

REVIVAL of British interest in Mexican mining affairs is indicated by the organization, in London, of a new corporation having unusually ample financial backing, "with a view to the acquisition of some apparently highly promising interests in Mexico that the parent companies' management has recommended after investigation". We quote our esteemed contemporary the 'Financial Times'. The "parent companies" that are co-operating in this venture are the Camp Bird and Santa Gertrudis, which recently acquired control of the El Bordo group of mines at Pachuca, in Hidalgo. The capital of the new company, called the Mexican Corporation, Ltd., is £1,000,000. We forbear from translating this sum into dollars because the old rate of exchange has become fictitious and the current one is too variable to permit of accurate equivalency. Of the capital, £850,000 has been placed 'firm' with the following representative mining companies: the Consolidated Goldfields of South Africa, the Consolidated Mines Selection Company, the Central Mining Corporation, the Imperial & Foreign Corporation, the Lena Goldfields Company, the Lake View group of companies, and the Exploration Company. The remaining £150,000 of the issue will be offered *pro rata* to the shareholders of the Camp Bird and Santa Gertrudis companies and will be used as working capital; it has been underwritten already. This flotation will have the effect of releasing the whole of the earnings of the two parent companies for distribution in the form of dividends, instead of using the earnings for new business. The Mexican Corporation is remarkable on account of the talent and character represented on its board of directors, namely, Mr. Frederick W. Baker, chairman of the Camp Bird and Santa Gertrudis companies, Mr. R. T. Bayliss, chairman and managing director of the old Exploration Company, at one time so honorably prominent in Western American mining, Mr. Walter McDermott, chairman of the Consolidated Mines Selection Company, and formerly managing director for Fraser & Chalmers, Mr. F. A. Govett, chairman of the Lake View & Oroya and Lake View & Star companies, and formerly closely associated with Mr. H. C. Hoover in many Western Australian ventures, Mr. A. Stanley Elmore, of flotation fame, a director of the Camp Bird and Santa Gertrudis companies, Mr. H. Guedalla, a director of the

Burma Corporation, Mr. John A. Agnew, an American mining engineer who may be said to have stepped into the position rendered vacant by Mr. Hoover's retirement from British mining activities, and Lord Brabourne, a director of the Consolidated Goldfields of South Africa, the Natomas Land & Dredging Trust, and the Oroville Dredging Company. It would be difficult to select a group of men more representative of London mining finance. We wish them complete success in their new enterprise, feeling confident, among other things, that no such performances as marked the flotation of the Santa Gertrudis will be tolerated by them. We refer to the heavy promotion loot taken by the consulting engineer of the Camp Bird when that company acquired the Santa Gertrudis mine. Messrs. Bayliss and McDermott stand conspicuously for the highest code of conduct in mining affairs and some of their colleagues share that reputation with them. Apart from its personnel, this enterprise is notable in that it suggests an optimistic view of Mexican political affairs and an expansion of British activity in the exploitation of Mexican mines.

DURING the week we received a friendly call from a Denver mining engineer, and in the course of conversation he asked whether there was much mining still being done in the Mother Lode region of California. We are used to the question and have learned not to resent the suggestion that gold mining in the historic districts of this State is largely a matter of the past. The impression that it is so is due to the unwise policy of the local syndicates that operate most of the mines, efficiently and successfully, but with an archaic love of secrecy that does them no credit and detracts from the good repute of the Mother Lode region. Despite the long-continued productiveness of such splendid mines as the Kennedy and Argonaut, despite the highly successful re-opening of the Plymouth, and the more recent expansion of operations at such mines as the Carson Hill group, it is difficult to engage the interest of capitalists in Mother Lode mining because so little publicity has been, or is being, given to the operations extending through the counties of Tuolumne, Calaveras, and Amador more particularly. Here is the place to acknowledge the notable service performed by Mr. W. J. Loring, himself a native of California, who induced British capitalists to join with him in re-opening the Plymouth, in Amador, which has already produced $3,400,000 worth of gold, yielding a profit of $1,000,000, since the resumption of work under the Plymouth Consolidated Gold Mines Ltd. in 1913, and the total expenditure of $960,000. Mr. Loring likewise induced some of his Boston clients to finance the operation of a group of old properties in Calaveras county, including the Morgan and the Calaveras Consolidated, covering 9650 feet on the lode, and these are now producing $100,000 of gold monthly. Again, he re-opened the Dutch and App mines in Tuolumne. We mention these facts with no little pleasure because Mr. Loring, after wide experience in other countries, has returned to California and set to work with a proper regard for such publicity as is helpful to all concerned. The companies with which he is connected issue monthly reports and are always willing to supply information to those having a proper reason for asking it. We commend this example to his neighbors.

ROMANCE still survives in mining, as is suggested by the story of the discovery made at Randsburg in southern California. Mention of it has appeared in our news columns from time to time. It appears that a couple of prospectors, of the kind known in the South-West as 'desert rats', one of them being a half-breed Indian, together with a former sheriff of Kern county, were grubstaked by a group of citizens living at Bakersfield. The two prospectors are Hamp Williams and John Nosser, and the ex-sheriff is Mr. John W. Kelly. Their backers were Messrs. Alfred Harrell, J. M. Jameson, E. T. Grady, J. A. Hughes, Dough L. Clarke, and two ladies named Ruby Southwick and Edith Coons, the last being the former Assessor of Kern county. These seven subscribed $200 apiece for the venture. In June the prospectors located a claim in an old mining district, being influenced to do so by an outcrop that apparently had been overlooked in days gone-by. The site of the discovery is within 1½ miles of the town of Randsburg, in San Bernardino. It is a district known chiefly for the success of the Yellow Aster, a gold mine of some celebrity and about 2½ miles from Atolia, famous for its tungsten. The first assay of a piece of quartz showed $75 in silver, as argentite. A hole 21 feet square was sunk and is now about 50 feet deep. Everything that has come out of it has been shipped to the Selby smelter, near San Francisco. The discovery was within a hundred yards of a paved highway and only three-quarters of a mile from a railroad, the Santa Fe line between Kremer and Johannesburg; so all that the diggers had to do was to shovel the ore into a motor-truck and take it to the old siding that the railroad officials had almost forgotten. They started on an 18-inch streak of high-grade ore that widened to 15 feet, all of it suitable for shipment in carload lots that averaged 150 ounces per ton. The original capital subscribed for the venture was $1400; the fortunate adventurers have received $250,000 already. When Nosser and Williams had sunk 30 feet they decided that a little 'real money' would be welcome, so each of them sold half of his eighth interest for $50,000 apiece to a group of Bakersfield merchants. They still retain their respective sixteenths. They have located the whole country around their 'glory hole', besides a townsite. Reserving 600 by 800 feet of ground around the discovery, they are leasing the outside territory in sections 200 ft. wide and the full width, 1500 ft., of their property, at royalties ranging from 15 to 25%. The enterprise has been organized as the Rand Divide Mining Company and the stock will be distributed among the present shareholders. It may be far from Divide and still farther from the Rand, but this young mine seems worthy of its sponsors. We would like to see them develop it and reap the full fruit of their enterprise.

The Diesel Engine in Mining

The first notable installation of Diesel engines for mine-power is described in this issue by Mr. C. Legrand, engineer to the Phelps Dodge Corporation. To many it will seem like a far cry from the introduction of the Diesel engine into the United States in 1903, to the Phelps Dodge installation at the Burro Mountain property in 1912, nine years later. The original Diesel patents were taken out by Dr. Rudolf Diesel in 1892, but it was not until the St. Louis Exposition in 1904 that we first saw a Diesel engine. It had been brought to the United States from Germany by the late Adolphus Busch, who afterward acquired the American rights to manufacture and sell under the Diesel patents. Thus was born the so-called American Diesel engine, as distinct from the English, French, Italian, Belgian, German, and Swiss Diesels, which were built under license from the inventor, one license being issued for each country. But the development of the American Diesel lagged, while Europe took the Diesel seriously and went vigorously to work to solve the many complex mechanical problems involved in converting the theoretical Diesel cycle into a practical power-generator, and soon the Willans-Diesel of England, the Tosi-Diesel of Italy, the Sulzer-Diesel of Switzerland, and the Carels-Diesel of Belgium were favorably known. Each was the same in fundamental principle, but differed in mechanical details.

The Diesel cycle created a set of new and unprecedented conditions in engine design. The pressure of compression in the cylinder is about 480 pounds per square inch; the temperature is about 1000°F. at the time the fuel is sprayed through the atomizing-nozzle at a pressure of from 900 to 1000 pounds per square inch. These working pressures and temperatures require the greatest nicety of cylinder design and foundry mixtures. The engines in the Burro Mountain plant are fitted with water-jacketed cylinders, pistons, cross-head slides, cylinder-heads, and exhaust-pipes, and on the efficiency of the cooling-devices depends to a considerable extent the continuity of operation of the engine. The classic treatise of Dr. Diesel, published in 1893, had the title 'Theory and Construction of a Rational Heat-Engine to Replace the Steam-Engine and Internal-Combustion Engines of Today'. Allowance may be made for the exuberance of the inventor, for without detracting in the least from the undoubted epoch-making character of the Diesel cycle, neither the steam nor the so-called gas or Otto-cycle engine has been replaced. On the contrary, each has developed its own field of application through its individual characteristics, the Diesel engine adding itself to the ranks of power-generating devices without displacing either of the other two. Undoubtedly the engineering and economic considerations that prompted the selection of steam for the Inspiration power-plant were just as sound as those that caused the selection of Diesel engines for the Burro Mountain plant. If fuel consumption were the only element to be considered, and oil were available, the Diesel would sweep the field for every power purpose except motor-vehicles; but many other points also influence the selection of power-generators. The questions of load-factor, overload capacity, and the cost of each type of fuel at the power-house site are of prime importance. The four-stroke cycle engine is expensive in first cost, as compared with the same number of power impulses offered in the single-cylinder steam-engine. The two-stroke cycle engine is cheaper than the four-stroke, but not so economical of fuel. The overload capacity is low as compared with the steam-engine, about 15% as compared with 50%, or even 75%, for steam for short periods. Therefore, in a Diesel installation it is necessary to install power-capacity nearly equal to the peak-load, whereas when using steam, from 20 to 40% less than peak generally suffices, provided peak-load conditions are of comparatively short duration.

The grouping of certain power-driven units entering into the average installation of mining and milling equipment with respect to their load-factors is the best plan to pursue, where the installation is large enough to warrant it. Fairly constant loads and a correspondingly high load-factor lend themselves admirably to Diesel engine power. A Diesel engine driving a generator for furnishing power to mills running 24 hours per day would be ideal, and even hoisting-engines fitted with a fly-wheel motor-generator set are adaptable to this type of power, provided the hoist is in fairly constant operation during all three shifts. One interesting characteristic of the Diesel engine is its high efficiency for fraction-loads, there being almost no difference in fuel consumption per horse-power between full load, three-quarter load, and half load. Another is its catholicity of taste as far as fuel is concerned. Anything that is fluid and will burn will drive a Diesel engine. Any old oil, animal, vegetal, or mineral, derivatives from various distillation processes, artificial hydro-carbons, residues, and nut-oils will work, and work well. There are a number of Diesels burning gas-house tar. The tar is dumped in its solid form into a tank fitted with coils heated by the exhaust from the engine, and that is all there is to it. A test on the block was made in the plant of an Eastern manufacturer, and four barrels of fuel-oil were provided for this purpose. The test proceeded; it was satisfactory, and the engines were accepted. A few days later, the shop-foreman ran across the identical four barrels of oil that were to have been used for the test, intact as to contents. Non-plussed, he reported his discovery to the superintendent, who, after investigation, found that, by reason of their external similarity, four barrels of fish-oil, intended for the bolt department machine-tools, had been used for the test, and the Prony brake did not know the difference.

It is a melancholy circumstance that Dr. Diesel, fresh from many honors and a gratifying recognition of his great achievement from the world of technology both in the United States and abroad, mysteriously disappeared from the deck of a Channel steamer on his way to England, and ostensibly was drowned just as his career had reached its zenith. A short time later, the country of

his nativity plunged the world into the greatest war of history, and based its hopes of success on the Diesel-engine equipped U boats that were to starve England into submission and prevent the passage of American troops to war-torn France. We are pleased to record a higher use of his genius in the winning of metals from their ores for the peaceful needs of civilization and the solving of economic problems for the benefit of mankind.

A Federal Department of Public Works

On another page we print the text of the bill to create this Department and to define its powers and duties. The bill was introduced in the Senate by Senator Wesley L. Jones and in the House by Representative Charles F. Reavis. The proposal that it embodies has been the subject of interesting discussion among engineers ever since Engineering Council called a convention to meet at Chicago last April for the purpose of considering the proposal. This convention was attended by the representatives of 74 engineering societies and showed marked unanimity of sentiment in favor of the proposed national department, which is to include all "the bureaus and services of the National Government having to do chiefly with matters of engineering and architecture". The idea is not a new one; it was advanced 35 years ago and has been revived in consequence of the experiences of the War period, during which it was found that the engineering activities of the Government were scattered among six departments and thirteen bureaus, producing a costly duplication of effort and a great waste of public funds. The subject was brought before the engineers of San Francisco by Mr. Philip N. Moore while he was here as a member of the Commission on War Minerals Relief. He addressed several representative audiences and aroused keen interest in the proposal by his lucid and convincing presentation of the arguments in favor of it. Himself a member of Engineering Council, he described how it was organized and how it had felt its way to useful work, culminating in the appointment of an Engineering Service Committee, at Washington, the expenses of which were underwritten by Mr. J. Parke Channing, the president of Engineering Council. The mere fact that an individual, and not the engineering societies, had to finance this work suggests the unorganized condition of the profession. Experience at Washington prompted the calling of the Chicago conference, which elicited a splendid spirit of co-operation and led to the drafting of the bill now before Congress. The Secretary of the Interior is the head of more engineers than any other department in the world, and it is pleasing to note that he has stated that the proposed Department of Public Works "is in the interests of efficiency and economy, and is inevitable". Those who have participated in various phases of engineering work at Washington during the last two years have been impressed by the waste of energy and money due to the over-lapping and rivaling of the various bureaus. Three departments will gauge the same stream and four departments will collect the same statistics. We in California may recall the fact that an inquiry into the quicksilver industry, with a view to ascertaining the supply of mercury needed for munitions and other warlike purposes, was made successively by the Geological Survey, the Bureau of Mines, the Department of Commerce, and the State Mineralogist. The statistics of the Geological Survey are not available to the Bureau of Mines; so it starts to compile its own; any request for the data in the possession of the other bureaus has to go from the chief of that bureau to the chief of the other, and so up and down the ranks of officialdom. Each bureau is under a separate Assistant-Secretary of the Interior. The Bureau of Forestry is under the Department of Agriculture and controls water-power resources. Three departments direct the mapping of the national domain. The Bureau of Roads, essentially an engineering service, is likely to spend more money than any other and is under the Secretary of Agriculture. Each department and each bureau strives to magnify its operations in order to obtain an increased appropriation from Congress; it is considered a sin to have an unexpended appropriation or to allow another bureau to perform the same duty; yet as soon as one starts on a given piece of work another will follow suit. The commission sent to Europe by the Bureau of Mines to report on the condition of the mines in the devastated areas arrived when a similar Army commission was just finishing its work and these two commissions went over ground that was also covered by a commission sent to Europe by the Geological Survey. Obviously it is high time to correct such abuses. The various engineering services of the Government spend 60 million dollars per annum and 600 millions is to be spent during the next decade in highways alone. It has been the dream of the great engineers and leaders of the profession for the time of more than a generation, particularly of the civil engineering branch, and now the other branches of the profession, influenced by their war experience, are joining in a united effort to turn the dream into a reality. It might have been well to create a new department of the Federal government with its own member of the Cabinet, but the opposition to such a change would have been greater than the placing of the principal engineering activities under the direction of the Department of the Interior. The bill provides that the change shall be made when the present Secretary of the Interior shall vacate his office and it stipulates that his successor shall be an engineer, with four assistants at $7500 per annum, appointed under Civil Service rules and therefore not at the mercy of political patronage. There will be opposition, of course, from the officers of the Army, and there remains the possible antagonism of the labor organizations, but if engineers throughout the country take pains to ventilate the subject, so as to obtain public support, and therefore Congressional help, this great plan to improve the Federal administration will be effected in due course, to the benefit not only of the engineering profession but of the Nation.

The Crowe Process

The Editor:

Sir—Referring to Mr. Keith's remarks on the Crowe process in your issue of August 23, I am inclined to think that few metallurgists will agree with Mr. Keith's position in reference to the Crowe patent.

Anticipation is not invention. It is safe to say that no invention of value was ever conceived out of a clear sky. It is for this reason that all patent applications are referred to as 'improvements'. If anticipation were invention, it would be quite easy to show that no one ever invented anything. It could even be shown that Columbus did not discover America and that Wilson and Lloyd George do not deserve much credit for the League of Nations, for, was it not Garrison who said, "The world is my country and mankind my countrymen".

Any indefinite information that lies dormant for many years, should not be a bar to a valid patent if an inventor evolves something worth while out of the chaos. It is probably this view that largely governed the U. S. Supreme Court decision in the flotation patents.

Denver, August 25. W. E. GREENAWALT.

A Metallurgical Journey to Shasta

The Editor:

Sir—I have read with interest Mr. Herbert Lang's article, particularly his description of the attempts to smelt the copper ores of Ingot. I am sorry, however, that more information was not given about the earlier attempts in this direction, as I have tried at various times to get this information.

In 1915 the late James Sallee told me of the heap-roasting of copper ores at Ingot, or Furnaceville, as the place was first called. Mr. Sallee spoke also of an attempt to smelt this roasted material, the objective being a matte of sufficient grade to stand shipment to Swansea. This, I think, was thirty or forty years ago. Acting on this information, in 1917, I secured a lease on the Furnaceville burning-ground, which had evidently been forgotten during the various stages of operation and idleness of the mines during these years. Indications showed plainly a long lapse of time since any operations and nothing remained of the smelting-plant, but limestone, charcoal, and considerable slag or matte was found just below the roast-heaps. It is interesting to note that the slag assayed only a little less than the roasted ore, and was all included in my shipments.

The ore was well roasted but the method of roasting differed from the later practice at Butte and in British Columbia as circular pits about four feet deep and 35 ft. wide were made in the ground, the roasting being done in these pits.

The smelter assays on six cars of this material were as follows:

Tons	Gold, oz.	Silver, oz.	Copper, %
37.8	0.05	13.15	6.17
42.2	0.05	14.15	6.69
49.1	0.03	13.99	5.31
47.5	0.015	8.20	6.01
42.7	0.03	9.55	4.58
41.6	0.05	11.45	3.90

G. CLEVELAND TAYLOR.

Redding, California, August 23.

The Status of Gold

The Editor:

Sir—Inasmuch as it appeared to me that the debate on this subject was assuming a decidedly academic slant, I had not intended contributing anything further to the discussion. However, two articles have lately appeared that seem to call for some comment. One is by R. B. Brinsmade, in your issue of August 16, and the other is by Irving Fisher in the 'Magazine of Wall Street' under the same date.

It is quite evident that Mr. Brinsmade is a student, and a deeply read one, of political economy. It is further evident that he possesses pet theories regarding taxation as applied to land-values and to inheritances that may have quite as blinding an effect upon his reasoning as, so Mr. Brinsmade accuses, does the monetary theory of Professor Fisher upon that gentleman's reasoning. In my letter, which you printed on February 1, I advanced certain suggestions designed to correct evils in our monetary system and at the same time to lighten our load of taxation. Mr. Brinsmade says my scheme is all wrong, but that all our debts can be readily paid merely by more and differently applied taxation. This looks to me like trying to cure a delirium tremens patient by increasing his consumption of alcohol.

Mr. Brinsmade says, "It is true that much of the money invested in these war bonds was gained with less work than in normal times, and if the policy of permanent price-inflation had merely to do with the re-payment of war-bondholders much could be said for its justice and expediency. Unfortunately, however, a permanent inflation of prices means a general defrauding of creditors by their debtors and such a general social disturbance that no thoughtful economist would advocate it except as a last resort to avoid national repudiation." He then states that the land-value tax and the inheritance tax are

[illegible] great yields, that fourth-fifths of our great [illegible] inherited, that 2% of our population owns 60% of our wealth, and, finally, "the national health would therefore be vitally stimulated by abolishing our aristocracy, along with our war debt, by a graduated inheritance tax."

He accepts that if the payment of war debts were the only object of my proposals, they might be both just and expedient. Unfortunately, he says, the resulting high prices works harm to the creditor class. Even this harm thoughtful economists would condone if the result would be to prevent repudiation of national debts. After this he approves of abolishing our 'aristocracy', along with our war debt, by means of a graduated inheritance tax.

It is quite generally accepted as true that the bulk of our great fortunes consists of credits. For example, capital stock of a corporation is a liability of the corporation and is a credit in favor of the holder of the stock. Corporate and other bonds are direct obligations to pay. If four-fifths of the great fortunes are inherited, and if 2% of our population owns 60% of our wealth, we can figure that 1.6% of the population are in the combination creditor-inherited wealth class and that this class holds some 48% of our total wealth. If this is the outfit that Mr. Brinsmade is after, why not deal them a swift blow with a change in monetary standards instead of inflicting slow torture through the inheritance tax? Why not rest the burden on the shoulders of grown men rather than upon the bodies of babes and children unborn? A confiscatory inheritance tax is no better than anything else that is confiscatory, and Mr. Brinsmade will have to do away with paternal and maternal instincts before he can get anyone to subscribe to the full measure of his program.

Throughout this discussion there has been a clearly defined difference in opinion as to what will happen and should happen to prices. Professor Fisher states that we are on a permanently higher price-level. I do not hesitate to reiterate my statement of last February to the effect that one who engages to readjust price conditions by decreasing the scale of living attempts the impossible. As Professor Fisher points out, the present is but a single one of many price changes. Why shall we assume that the prices of 1913-1914 are correct in every particular? Although I am no octogenarian, I can remember when men worked for a dollar a day and brought up families without going into debt. Why should we not bring prices down to where this is once more possible? Why not reinstate conditions that made it possible for five cents per day to do what five dollars per day does now? Prices and wages are up to stay, just as they went up and stayed up more than once in past history. The man who cannot grasp this fact can present no reasonable argument. If we guard ourselves against fraudulent and fictitious advances in prices, now commonly known as 'profiteering', we do all that we can do.

Not all the political economists are so imbued with the sacredness of the gold eagle in its present magnitude that they brand one who worships not this idol as a disreputable type of iconoclast. Professor Fisher, in the article to which I have referred, advocates a gold coin of variable weight but of fixed purchasing power. If his suggestions were put in practice the gold dollar would be diminished to half its present weight. If gold were demonitized, and free bidding for the available supply were permitted, it is my firm conviction that each gold coin would be exchangeable for double the quantity of other things that it now is. I do not believe it practicable to change the weight of gold coins monthly, or even yearly, but I do believe that from now on, and so long as the gold standard is maintained, the weight of gold which represents a 'dollar' must be periodically decreased. The time when the decrease is to be effected will be the problem of each generation. It will suffice us of the present if we fit our gold supply to the needs of our times and quit our attempts to trim the needs to fit the gold supply.

While I am upon the subject, allow me to allude to the letter of J. C. McPherson which appeared in your issue of March 22. Mr. McPherson's main criticism of my proposals was that their adoption would inflate our money supply in the same degree that it would be inflated by a too industrious use of the printing-press. He asserts that my suggestions merely substitute the mint-stamp method of coinage for the printing-press method. I may say that such was the result contemplated. My belief is that the world needs more honest-to-God coin. Whether the new coin is yellow or white or both, I assert that conditions will be improved if the supply is augmented.

San Francisco, August 23. EDW. S. VAN DYCK.

A Message From South America

The Editor:

Sir—Travel broadens the mind, but it is also true that it brings a keener appreciation of all that which one leaves behind, when traveling abroad for a considerable time.

The world events of 1918 emphasize this so sensationally, that I ask the opportunity of recording the feelings of us American engineers and miners, generally, exiled abroad on business, and in particular, those in Spanish America. No matter how grouchy and unappreciative we may be at home, we quickly realize the comfort, privilege, and honor it is to be a citizen of the U. S. A., and to live within its confines.

There is no station or rank of life in the United States that does not shine by comparison with its similar parallel in the social organization of these countries. That is the sober opinion of one who has had considerable opportunity to observe and compare the manner of life of the poor, as well as those in easy circumstances, both here and in the States.

"Here" means seven Spanish-American countries, with an acquaintance of nine years duration. What American citizen duly appreciates the benefits of an abundant and sanitary supply of drinking-water, at the call of every home in his city? Or a healthy, varied, and nourishing food-supply in public, and in the home? Please don't smile and mention Hooverizing—there are

much worse things for the digestion that we encounter daily. No quantity of fiery *picadillo*, greasy *tamales*, soggy *empanadas*, and dubious *bifsté* can supplant American home-cooking, but they are what we get, willy-nilly.

Do you ever realize, you lucky Kansans and Californians, what it means to you to live in a community in which common honesty is taken for granted—honesty in all things, little and big? Where one does not have cause to regard the course of justice as subject to frequent deviations, due to the commercialization of the bench?

Who ever sees in Oregon or Iowa, a high adobe wall surrounding each private home, capped by a terrifying collection of broken glass, cemented into the top, to discourage the entrance of the constantly expected thieves and marauders? *En esta santa tierra*, theft is so common and accepted a fact that the transportation companies unite in official warnings to the passengers against it, and he who chooses to disregard this warning is bound to regret it, sooner or later.

Did it ever occur to you that life is more agreeable amid a population which is convinced of the benefit and necessity of frequent bathing, and where high-class plumbing and bath-room fixtures are in general demand? The simple manners of these lands make it almost impossible to find a rented house supplied with a stationary bath-tub; if you wish a bath in a tub, you must supply the plumbing and the fixtures, at your own expense.

Who ever hears of typhus epidemics in the States, yet this year people have been dying by scores daily in the capital city of that South American country whose citizens have often been dubbed the Yankees of South America, for the supposed degree of advancement the term implies; and yet typhus is purely and simply a filth-disease. Typhoid fever is endemic almost everywhere, and on the high plateau regions the same is true of pneumonia and smallpox.

This is enough of material things, perhaps, though I might mention the matter of house-rents in the larger cities, which, in my own experience have called for $75 to $80 U. S. money per month, for a house that would find few tenants in Denver or Los Angeles, at $16 to $18 per month. Not one house in a hundred contains the essentials (not luxuries) of the kitchen in the average American home; frequently the meals are cooked out in the enclosed yard, at the rear of the house, even in the case of numbers of supposedly fine residences, and I have, in my own experience, sat down at table with members of the staff of British and American legations where the food was served at table by servants who lacked shoes and stockings.

What American schoolgirl or schoolboy can really appreciate the splendid American school-system, which opposes no bar to poverty or religious belief; which supplies free health inspection, free city playgrounds, and, in many cases, free school-books? Do they realize the privilege of attending schools that are the last word in modern construction, and directed by a fine body of loyal and competent American teachers? Education is not unappreciated down here, but it has had to struggle against prejudice and jealousy in high quarters and the indifference of the ignorant.

If the native-born American has not hitherto duly realized the value of the privileges that have been his heritage, he can be sure that the European of cramped opportunity and the Spanish-American of humble station certainly do so.

Our boys who went 'Over There' with Pershing will bring back with them a new appreciation of their own land, as they have been receiving a high-speed education in national values, which will not be lost upon them. As one returning dough-boy said, "If this here place is that dear Europe, then for the Lord's sake, gimme Cedar Rapids."

Probably Congress will now provide an immigration law, with properly discriminative provisions; otherwise the States will be flooded with a heterogeneous mass, calculated to break up and drag down our laboriously built national structure to the level of the wreckage of Europe, which will soon be seeking admission.

Spanish America is too sparsely settled and too far away, except in the case of Mexico, to furnish a current of peon immigration to the States; however, it is now the hope of every ambitious Latin-American engineer, doctor, dentist, mechanic, or commercial aspirant, to make a trip to the States "*en busca de horizontes mas amplios*, or in plain language, to locate themselves in a better position for snapping up some of those dollars, which are sneered at, but never refused, by foreigners.

Thus, if others can weigh properly the value of that marvelous development of human effort and genius, known as the United States, why cannot we, its own citizens, do so more promptly, and without cavil?

These few thoughts have been hastily jotted down *en route*, and though without finished form, they are none the less sincere, and are a part of the basis of my own unhesitating faith in the institutions of our common country, in the honesty and stability of its people and its government.

America has won the honest admiration of the world for her powerful and unselfish support of its liberty, when so lately threatened by autocratic Prussianism; it will do us good to accept this widespread conviction of our collective quality, as our own, and thus strengthen ourselves in upholding the value of American ideals.

Contrary to a general belief, the American abroad does *not* make a practice of boasting offensively of his nationality; as a matter of fact, many Europeans, and some of the South American peoples, are much more disposed to offensive self-assertion and general 'cockiness' than the American abroad.

Without prejudice to our world-neighbors, let us try to realize more fully that we have a wonderful country, with a heritage of honorable history, second to none in worthy actions; and that it is our privilege and duty to help in maintaining its democratic institutions and handing them on in safety to our children.

Arequipa, Peru, June 25. MINING ENGINEER.

The English-Speaking Peoples

The Editor:

Sir—Being an American and having spent eleven active years in Canada, the letter of Mr. C. M. Campbell in your issue of August 9 appeals to me with particular force.

If I remember my Canadian history correctly, most of the fighting in 1812 was centred about the Niagara country, and upon the Canadian side was fought largely by British regulars assisted by French Canadians, while the United States forces were composed of irregular backwoodsmen officered by a few regulars. The battle of Stoney Creek was, I believe, a raid conducted by the American forces and was successful until a force of 600 British regulars cut off the retreat of the too exultant braves.

That battle of Stoney Creek looms large in Canadian history, and the monument, set high upon its supporting hill, looms still larger in the Canadian landscape, much too large, in fact, for the action which it commemorates. Be opinions as they may in regard to the importance of Stoney Creek as a factor in world affairs, we are confronted by the fact that the progenitors of the great mass of English-speaking Canadians were in 1812 living in Great Britain, Germany, and the United States, and played no part in the 1812 episode. At that time Upper Canada was a wilderness and only by the most far-fetched chauvinism has it been possible to glorify these backwoods squabbles into military traditions.

The industrial development of Canada has been due to the example of her big neighbor and it has been American enterprise and capital, even more than Canadian, that has enabled Canada to reach her present position. Moreover the war (?) between Canada and the United States was a fight between an exploiting imperialism and a struggling democracy, and it was the success of the United States republic which secured for Canada her own democratic institutions. The story of colonial wars has been worn threadbare and the military traditions have been blown up like a child's balloon in an endeavor to keep pace with the growth of Canada.

There has never been an American propaganda to 'annex' Canada; the habitat of that bogey lies north of the 49th parallel. The American 'invasion' of Canada has actually taken place by peaceful penetration into the North-West and has been encouraged by the Canadian government, with great benefit to Canada.

The United States has provided lucrative employment for ambitious Canadian boys who have found difficulty in securing employment at home, and the long list of successful Americans who were born and reared in Canada is a matter for mutual congratulation.

Until twenty-five or thirty years ago, Canada was undeveloped and stood on a par with South Africa, Australia, and New Zealand. The influx of American capital and the combined enterprise of Canadians and Americans have developed Canada from a colony into a nation. Canada today stands out as the only manufacturing dominion of Great Britain. The one industry that may lay claim to British birth and control is the Grand Trunk Railway, a glaring example of mismanagement. The moving of Canadian crops is done with American money; the promotion of Canadian industries and the sales of municipal, Provincial, and Dominion bonds depend upon American investors; the supply of semi-manufactured articles, such as skelp, wire, plate, and the like, upon which Canadian manufacturers depend, comes from the United States.

While the development of Canada is something for Canadians to be proud of, it in no way compares with the development immediately south of them. Along the southern shores of Lake Erie and Lake Ontario are conditions of prosperity tenfold greater than are found along the northern shores of those lakes. Canada has untold natural resources, but they are undeveloped largely because of the insularity which has characterized the past history of the country, an insularity inspired by a propaganda of distrustfulness toward American ambitions and ideals.

Happy the day when every man and woman born on the continent of North America shall have the right to vote anywhere upon the continent, with no other restriction than the usual residential requirements in regard to Federal, Dominion, State, or Provincial elections. I do not suggest a merging of Canada with the United States, but I do suggest that a Canadian resident in the United States should have the right to vote here, and an American resident in Canada should have the right to vote there, with no other formalities. The practice of making men forswear allegiance to one country and swear allegiance to another is a survival of a medieval custom, and has but one reason, an intention to go to war. If the United States and Canada do not intend to go to war with one another there is no reason for disfranchising a man when he crosses the boundary-line.

A short time ago I had a talk with Dr. McGillicuddy, who helped to run the 49th parallel, that mysterious imaginary wall which divides this continent in two. The greatest care was exercised in locating the line. As the survey parties approached the Rocky Mountains, the most careful determinations were made to correct the deflection of the plumb-bobs due to the influence of the mountain masses; sometimes when working with artificial horizons of mercury the work would be delayed for hours owing to ripples caused upon the surface of the mercury by vibrations transmitted from the hoof-beats of distant buffalo herds. They certainly spared no effort in exactly and precisely fixing the only barrier between the two countries.

If all of Canada stood on their side of that line and sang 'God Save the King' and all of the United States stood on our side of the line and sang 'America', there would not be the slightest discord. Any foreigner who could not understand our common language would think we were singing the same song; and so we should be; the same notes, the same ideals, and the same desire for free and enlightened political institutions.

If we could merge our most sacred political privileges, the right to vote, we should be serving notice upon Europe that the artificial enmity of the past century had collapsed. If we mutually trust one another there should be no objection to such a plan, and if we really intend to stand together in the maintenance of principles upon which we are fully agreed, and if we are both sick of the turmoil in Europe then we should start getting as close together as possible in order that no intrigue may cause a breach between us. The actual voting in one another's countries would not alter the politics of either country, but the moral effect of an interchange of voting privileges would be tremendous.

Our interests are so identical that we should get together politically as closely as we are financially and commercially, and not only work together as nations, but as individuals be at home in one another's countries, taking an interest in each other's affairs and working for the ideals in which we both believe.

And in order to further strengthen the bond, we might go beyond the exchange of political courtesies, and establish a Club of North America with branches in New York, Montreal, Buffalo, Toronto, Boston, and such other cities as might be advisable; a club in which every member would feel free to voice his opinions upon questions affecting the relations of the two countries.

A pious idea, born of the common Canadian and American tradition of burying the hatchet, might be to bury our war monuments. Let the club-building in the United States be founded upon stones taken from the Stoney Creek monument, and while we have no anti-Canadian monuments in this country, we might shed a tier or two from our Bunker Hill monument to provide corner-stones for the club-buildings in Canada.

The admission of returned Canadian soldiers who came in contact with American troops in France, that the American forces were equal to the Canadians in valor, and the testimony of the commander of the Australians that the Americans "delivered the goods" is sufficient military glory for any country. To be granted equality with the heroes of Ypres and Gallipoli should make the Stoney Creek traditions evaporate like a snowball in July.

Canadians and Americans are so identically alike in ideals, manners, and customs that they cannot recognize any differences themselves and have to ask one another what they are. In other parts of the world they are all classed as Americans; and in nine years of experience in South Africa I never knew a Canadian who could maintain his differential isolation; they would get tired of explaining to a non-comprehending audience that they were not Americans.

There is a paucity of human intelligence displayed in trying to keep open wounds that were inflicted one hundred years ago. Canadian and United States military tradition starts at Ypres and Chateau Thierry, and let us hope that it will end there. If we and Canada cannot get together, it is absolutely hopeless to expect European states to bury their differences.

Our two countries are more akin than any other two nations on earth; we think alike; we are bound together by financial, commercial, and family ties—in fact, by all the ties of advanced civilization; we understand each other and in the event of further European catastrophes we shall have to think and work together.

Let us get down to cases and make this North American continent so strong socially and politically that no European smash can affect us. We are the most constructive peoples in the world, so let us construct history in keeping with our present and future, instead of idly fondling the swaddling clothes of infancy.

San Francisco, August 12. P. A. Robbins.

War Minerals Relief

The Editor:

Sir—I wish to congratulate you on the way you stirred up the so-called Minerals Relief Commission for the blundering way in which they have handled the so-called relief measure. This measure at present is causing great suffering to numerous operators of tungsten properties, who were called upon by the Government to give aid at a time when our country was in great need of tungsten.

The Act was proposed for the express purpose of giving relief to such companies as the one which I have been responsible for bringing into existence. But the result is, that while our questionnaire has been filed in accordance with instructions from Washington, and our case before the Relief Commission has been submitted under oath, we are still without the slightest bit of information as to what relief we may expect.

The Relief Act was passed for the special purpose of relief as I understand it, and not to furnish expenses for making investigations alone. If we are to receive relief, why is it that we are forced to wait until such time as our creditors are likely to swoop down upon us and take our properties from us?

My candid opinion is that while the Commissioners are sincerely desirous of ascertaining the merits of each case, they are not as conversant with the facts of the cases placed before them as they should be, even after hearing them, as to realize the great danger some of these enterprises have been driven into on account of Government stimulation.

The Pacific Tungsten Co. submits a claim for $444,000. Any less award than the above amount will be a gross injustice to this company. I might say, in closing, that this is not a matter to be negotiated as if we were playing poker; it is a question of facts and the sooner these people are brought to realize that we are as much a part of the Government of this country as the Commissioners are, the sooner we will receive the relief we are entitled to.

Melones, California, September 2. W. J. Loring.

[The Commissioners are anxious to expedite a settlement, but the business of sifting the claims is laborious. An expert auditor has to pass upon them and the reports of the examiners have to be considered.—Editor.]

The Elm Orlu v. Butte & Superior Apex Litigation

By WALTER W. LYTZEN

What promised to be one of the cases most interesting to students of apex litigation, and most difficult of decision for the courts has been settled at the proverbial eleventh hour. After three weeks of testimony by the best geologists and engineers in the country, and the presentation to the Court of a set of exhibit maps and skeleton models superior to any heretofore made for litigation purposes, both sides to the suit agreed to a settlement, and asked the Court to sign the decree.

The Elm Orlu case, as it is generally known, involves the ownership of large bodies of zinc-silver ore, averaging during the years it was being mined close to 20% in zinc and 6 to 8 ounces of silver per ton, in the Rainbow lode. This broad vein system courses in a gently curving east-west direction along the northern border of the productive area of Butte, and in the early days was mined for its rich silver ore. The Rainbow lode is one of the few topographically prominent outcropping veins in the Butte district, and in places the quartz and silicified country form reef-like exposures, generally stained black with the oxides of manganese.

It was along this vein that both the Elm Orlu and Black Rock claims were located in the early days of Butte's history. Owing to its branching, and its segregated channels of ores, separated by granite only slightly altered, the true character of this vein was not understood at that time and locations rarely were made so as to have the main vein passing through both end-lines. Such was the case with the Elm Orlu and Black Rock locations, as also with the final plat as surveyed for patent. The Elm Orlu was the prior location, but the Black Rock patent was granted first. Owing to the failure of the Elm Orlu owners to adverse, the Black Rock patent included the surface areas in conflict.

From that date to about 1905, when the original Butte & Superior Copper Co. was formed, the two claims lay in friendly relationship, both being owned by ex-Senator W. A. Clark. About that time the Black Rock claim was sold to the newly formed Butte & Superior Copper Co. for $1,000,000, together with adjoining claims belonging to other owners. The hope of this company, as suggested by the name, was copper. Its early development was disappointing and the surficial silver ore did not change to copper ore in depth. When the zinc orebodies were encountered at about 1000 ft. in depth, the venture was regarded as a failure on account of the difficulties in milling and marketing the zinc ore. But improvements in concentration, especially flotation, together with perseverance and re-organization, put Butte & Superior on the map. During 1911, '12, '13, and '14 the orebodies increased in width as depth was gained, and laterally as drifts were extended.

Up to this time, owing to a lack of development on the upper levels, the geological structure was not understood and it was a distinct surprise when in July 1914 a suit was started by the Clark interests to obtain ownership to the orebodies in the western portion of the Black Rock mine by virtue of the Pyle branch of the Rainbow lode, outcropping within the Elm Orlu claim of prior location.

This first suit was brought in the Federal Court, District of Montana, before Judge George M. Bourquin. The decision awarded the plaintiff, the Clark-Montana Realty Co. and the Elm Orlu Mining Co., a portion of the Black Rock orebodies, the eastern limit being the decreed '301-ft. plane'. This point was where the evidence showed the Pyle branch to cross the common side-line to the Black Rock and Elm Orlu claims, and was 301 ft. south-east of the south-west corner of the Black Rock claim, as measured along the common side-line. The decision further stipulated that as to the eastward of this plane the facts as to the continuance of outcrop of the Pyle branch were unknown, and if future development should establish that the outcrop or apex or apices of the Pyle branches continued, a supplemental suit could be started and extensions farther eastward be claimed.

Judge Bourquin's decision showed a keen insight into the geological interpretation of mining law and was sustained by the Circuit Court of Appeals of the Ninth District. It was further sustained and complimented by the Supreme Court of the United States.

The suit just settled at Butte was therefore a continuance of the first suit, and, as the reserved decree stipulated, was for bringing before the Court evidence of further apexing of the Pyle branch eastward of the 301-ft. plane. The hearing had occupied three weeks, when suddenly, with all but one of the witnesses having been on the stand, a petition was presented to the Court asking for a decree based on a settlement arrived at by, and agreeable to, both sides. The hearing started on Monday, August 4, and on Monday the 25th the decree was signed.

The personnel of plaintiff's witnesses was as follows: Horace V. Winchell, James F. Kemp, Charles K. Leith, William B. Fisher, Fred Searls, Jr., and Rush J. White. The attorneys for plaintiff were John P. Gray, John L. Templeman, and Sidney Sannet. For the defendant Butte & Superior company, Albert Burch, William H. Emmons, Walter H. Wiley, Darcy Bard, Carl H. Hand, and Samuel Barker, Jr., were the witnesses; the attorneys being William Wallace, Jr., J. Bruce Kremer, and

William Scallon. The plaintiff was to call his six witnesses first and the defendant last. All the witnesses were on the stand except Mr. Bard, who was to be Butte & Superior's last witness. The cross-examination of Mr. Bard was not taken up as it was at the conclusion of his direct testimony that the proceedings came to an end.

The proceedings started with a snap and vim that promised a course in mental gymnastics to anyone who followed the testimony and kept himself in a judicial frame of mind. The question of whether or not all development work should stop so that the exhibits would be up-to-date without additions being made during the hearing was decided in the negative. This pleased Mr. Kinnear who had pleaded for the maintenance of work and it was later shown that the Butte & Superior had a few places they wanted to test more fully as to vein-age relations.

It must be borne in mind by the reader that the vein system of Butte exhibits three ages of fissuring, considered in a broad and general way. They are, in turn, the east-west or Rainbow system, the north-west system, and lastly the north-east system. The younger systems fault and displace the older ones. The characteristic throw of the north-west system is to the left and that of the north-east is to the right.

A glance at the accompanying map (Fig. 1) will show a coincidence of east-west Rainbow fissuring and mineralization with a pronounced north-westerly fault-plane, called the Black Rock fault, which throws the south-westerly striking veins to the right, and at the same time obliterates the normal effect these north-westers had on the pre-existing east-west system. This is important to remember because the '699' and Carlisle veins, claimed by the Elm Orlu side to be branching veins of the Rainbow, and to apex continuously within their claim, are regarded by the defendant Butte & Superior company to be

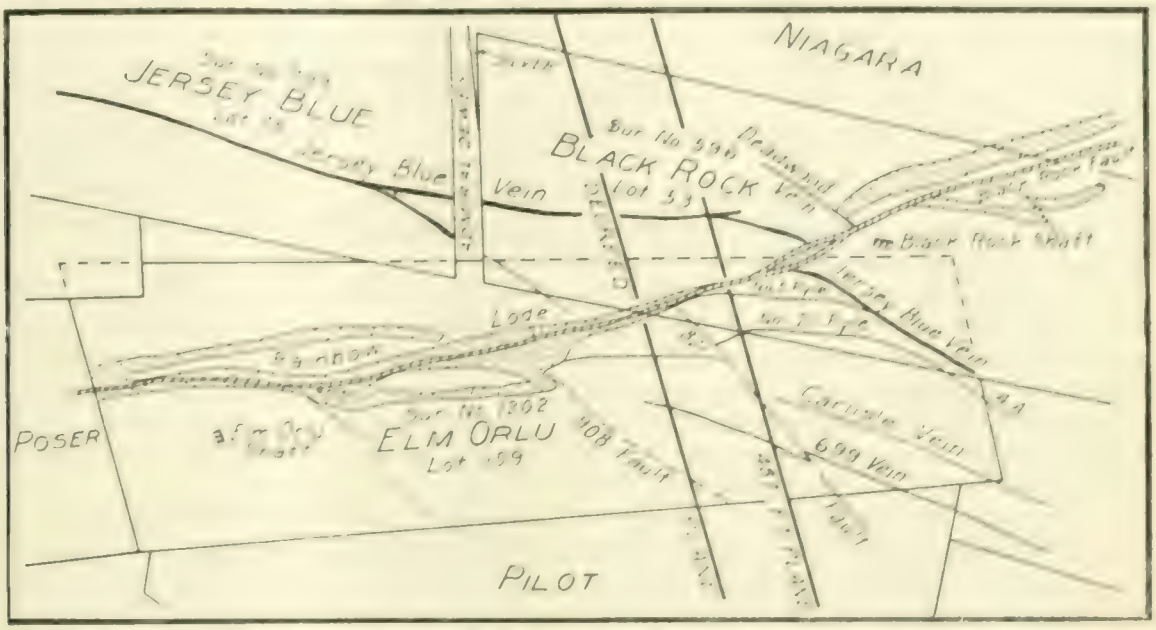


FIG. 1. PLAN OF THE BLACK ROCK AND ELM ORLU WORKINGS, SHOWING THE AREA IN CONTROVERSY.

typical north-west vein and not uniting with the Rainbow, but of later age and therefore cutting it. Much of the testimony was to this point and naturally in the broad vein-zone that had suffered two deformations the narrow quartz-manganese mineralization of the Pyle branches was difficult to trace. The evidence points definitely to its cutting through earlier mineralization.

John P. Gray of the Coeur d'Alene opened the proceedings by briefly reviewing the findings of the former hearing and what they guaranteed to the plaintiff as to the showings of future development work. He said that since the first trial nearly six miles of drifts, raises, and crosscuts had been driven at a cost to his side for their share, of close to $500,000; that the work done by the Elm Orlu company had shown that branches of the Rainbow vein other than the one considered in the first hearing coursed easterly and southerly throughout the length of the Elm Orlu claim, and united and joined, both on strike and dip, with the Rainbow vein. These branches, Mr. Gray continued, were characteristic throughout the entire extent of the Rainbow vein, and the '699' and Carlisle veins were not unlike the Rainbow mineralization, having [illegible] and size along their course and in depth.

The first witness for the Elm Orlu side was Rush J. White. Mr. White comes from the Coeur d'Alene, where, as mining superintendent and geologist, he has had a broad training. Mr. White was personally connected with the Star and Sunset mines [illegible]. His connection with this case started in December, 1907, when, at the untimely death of Paul Armstrong, he took charge of the development work for the Elm Orlu Mining Co. in preparation for this suit. As he had been in almost daily contact with the work and had had an opportunity to examine the mineralization when freshly broken, his direct testimony was very valuable. Mr.

White described in detail the various development openings driven by his side and the geological structure disclosed. The '699' and Carlisle veins were traced in the different drifts and raises, and his notes as to the widths of mineralization and of the altered granite were given in detail. It was apparent that, with the exception of the more northerly Pyle branches, the veins apexing within the Elm Orlu claim, upon which the plaintiffs hoped to establish their right to the Rainbow orebodies, were very narrow and often interrupted by faulting.

Quartz and manganese minerals alone constituted the material brought in, and only by claiming undue portions of altered granite could the veins be classed as of recognizable size. In many places quartz was entirely lacking and in others its width was measured in fractions of an inch. A lining of gouge was to be noted along these veins, the witness said, and the strike of the veins, as readily seen on the exhibit maps, was strongly northwest.

The various raises put up on the branching veins were followed up from the alleged junction with the Rainbow vein, with the aid of many separate raises on different planes. In two instances the raises not only followed the dip inclination, but also, inclining strongly to the east as they ascended, were finally brought up to the surface or to adits slightly below the surface. The reason for this was that many buildings, housing hoists and other necessary operations connected with a going concern, would have been endangered by continuing to the surface. The reason for the side inclination to some raises was given as the desire to avoid some faults that were due to pass through if the raise was put up normal to the strike. This, and the use of raises not continuously in one plane, was vigorously attacked by the Butte & Superior counsel in their cross-examination of Elm Orlu witnesses. The section maps of the plaintiff were on planes parallel to the Elm Orlu end-lines and at quite an angle to the strike of the veins. Necessarily, in making these sections, it was necessary to resort to projection.

The cross-examination of Mr. White was not so much to make his testimony contradictory, as to emphasize the smallness of the real mineralization and its lack of continuity by much north-west structure, and the latitude the geological projection allowed in making the vertical sections.

It was a disputed point all along as to which structure should have been followed when branching or splitting occurred. One raise in particular on the '699' vein, which the Butte & Superior side claimed to be vertical, was carried down by the plaintiff by following all north-dipping splits and ultimately coming on the Elm Orlu 1000-ft. level in the vicinity of the Rainbow vein. Testimony later by the defendants tended to show that by cross-cutting south, on several levels a vein was picked up on each, that correlated exactly with the upper 400 ft. of the vein followed by this raise. The defendant's contention was that much of the alleged continuity of these branch veins was due to the fact that a person starting at the apex of, say, the '699' vein, even at the most easterly opening, could descend through Elm Orlu raises for certain distances, then by a drift connection to the top of another raise, and so forth, finally arrive at the alleged junction of these branching veins with the Rainbow. The contention was also that the physical connection was only possible by using all three ages of geologic structure and evidence was pointed out by defendant's witnesses to uphold this interpretation.

This branching on strike was interpreted by each side differently and what, on direct testimony by Elm Orlu witnesses, appeared to be a nicely behaving and continuous vein, continuing to and joining with the Rainbow vein, was quickly separated into its alleged components by cross-examination. Naturally, in this small area three successive ages of fracturing would produce a complex fissure that would branch and re-branch. Many of these fractures would stop apparently, to be continued on the side by another that in reality would be the same. This was shown to be actually possible by Mr. Searles, witness for the Elm Orlu side, when he introduced a block of wood to support his explanation of the branching. The block had been struck a hard blow, and along the grain a fissuring was set up that both branched, and apparently stopped, only to continue again to one side. Mr. Bard, for the defence, introduced a piece of plate-glass that illustrated this same effect. The intention of this last exhibit, however, was to support the opposite view.

Mr. Bard, in defining the Rainbow lode, said that the various channels and branches need in no way be considered as a unit; that each piece of the vein was distinct and separate, and if being mined by a miner would not present evidence to justify him in cross-cutting the walls in the hope of finding another similar structure. But it is to be noted that the Butte & Superior has cross-cut the walls and found similar structures, and stoped thousands of tons of rich ore from them.

The foregoing illustrates how widely at variance were the views held by the two sides. All through the testimony the interpretation put on certain structures was as far apart as is possible to conceive.

The map-exhibits, for instance, prepared for both sides from the same surveys, showed no apparent discrepancies in outline, but the Elm Orlu maps with their broad red bands contrasted sharply with the modest red coloring on the Butte & Superior maps. The difference depended upon how much altered granite each side deemed permissible in estimating the widths of the veins. The plaintiff naturally emphasized the homogeneity of the vein-structure, whereas the defendant clung to Mr. Bard's theory of separateness and individuality of the branches. Mr. Kemp, professor of geology in Columbia University, witness for the Elm Orlu side, after stating his belief as to the No. 5, '21', '699', and 'Carlisle' veins being branches of and uniting with the Rainbow, was cross-examined by Mr. Wallace. The lack of gouge in places and of quartz in others did not destroy the continuity of the vein, said Mr. Kemp, who likened the vein to wall-paper with nu-

merous holes in it. The vein, regardless of the holes, could be followed, and was continuous. As to the intervening granite of the broad Rainbow face being pyritized and therefore indicative of vein formation, the Professor replied that the granite here upon analysis contained nearly twice as much sulphide as other typical analyses of Butte granite. The question how large a 'horse' could be and yet be called a 'horse', was finally limited by the witness to a length of 400 ft. Between the channels of ore are large elliptical masses of granite, in places pyritized and hydrothermally altered, that by the plaintiff's construction are deemed part of the vein and by the defence are held to be country. Mr. Wallace asked Mr. Kemp if a 'horse' might be in the Shetland or Percheron class, or even stretched to the elephant class, whereupon the witness replied that he would limit it.

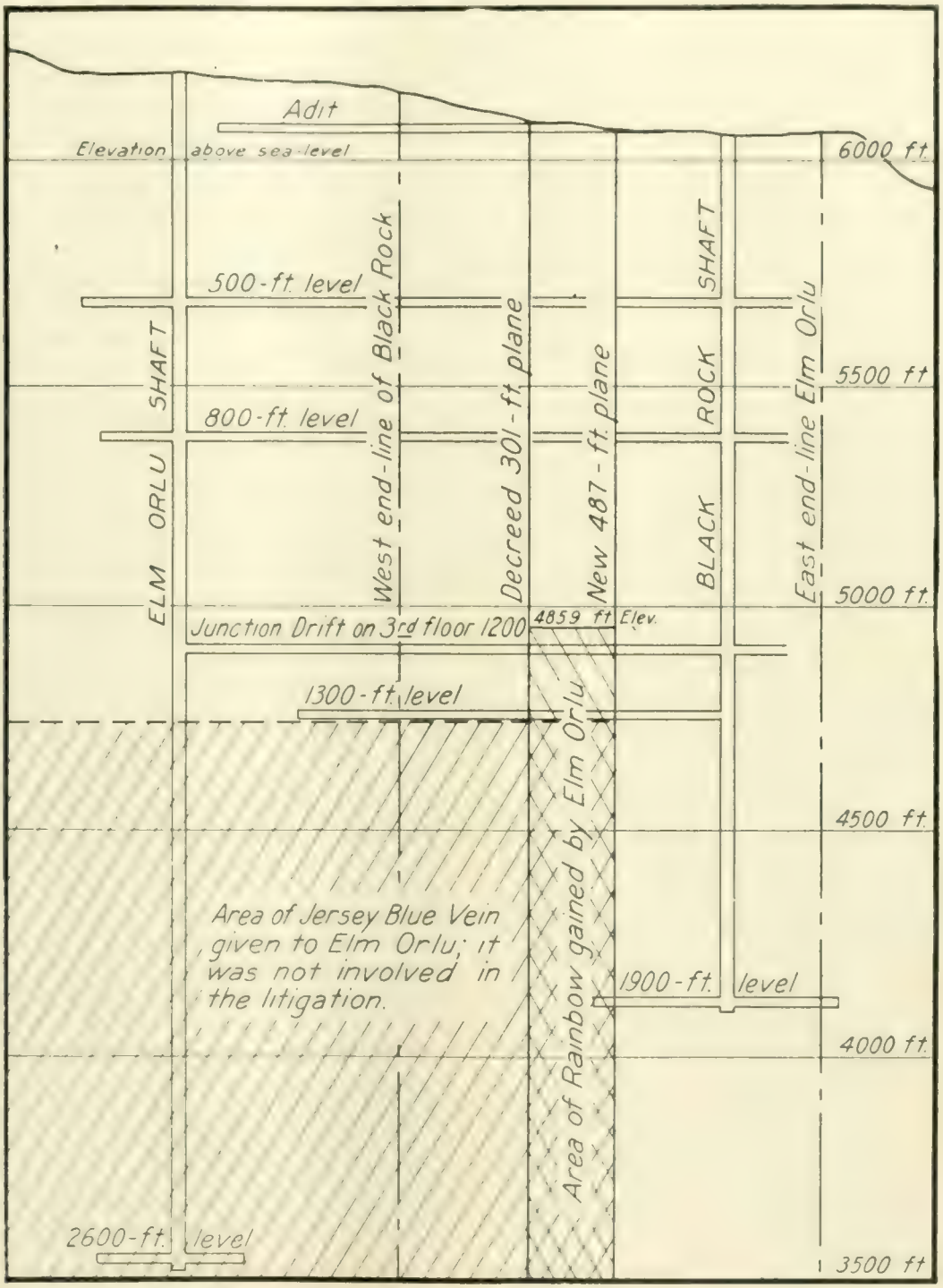


FIG. 2. EAST-WEST LONGITUDINAL PROJECTION SHOWING THE AREA IN CONFLICT

Mr. Leith of the University of Wisconsin followed Mr. Kemp. Mr. Leith defined a vein as having five necessary elements: (1) mineralization, as quartz, manganese, zinc, etc; (2) mineralized granite; (3) gouge; (4) one or more walls; and (5) a banded or sheeted structure. Ordinarily, the witness said, it was necessary to have more

than one element to constitute a vein. On cross-examination by the defence he was closely questioned as to pyritized granite alone constituting a vein, the plaintiff having claimed much of this material, especially where altered, as 'vein'. Mr. Leith said he would hesitate to follow such granite as a vein unless bounded by a wall and a continuation of at least some quartz mineralization. Mr. Kremer questioned the witness as to widths of pyritized granite allowable within his conception of a vein, and was answered 10 feet.

It was noticeable all through the testimony that the Elm Orlu side wished to include the altered granite in the lode-structure, whereas the Butte & Superior endeavored to limit veins to 'brought in' material, such as quartz and manganese. The question of assay-values in zinc, lead, or copper was mutually avoided on account of the accepted fact that 'commercial' ore only began at about the horizon of the alleged junction. The main point of the suit, on the part of the plaintiff, was to establish a continuity of vein between the apices of the various Rainbow branch-veins contained in their claim and the main Rainbow orebodies as developed by the Butte & Superior company. Naturally the defendants tried to show by their development in this same area that the veins used by the Elm Orlu company were not continuous, but segments of veins, and the main structure followed was of later age and of a different type of mineralization.

Mr. Emmons, professor of geology in the University of Minnesota, witness for the defence, gave clear and instructive testimony along this line. His statement that the east-west Rainbow type of vein was pre-eminently a replacement, and the north-west veins the results of a fissure-filling process, got him into trouble on cross-examination, when Mr. Gray read from one of Mr. Emmons' recent books, 'Principles of Economic Geology', that both east-west and north-west veins were of the replacement type. The importance of this lay in the fact that the witness claimed to be able to distinguish, by the massive or mottled appearance of the replacement type, between the east-west veins from the north-west veins, which he claimed had a banded structure from the nature of their formation.

Much of Mr. Emmons' testimony was a description of vein-structure and consequent identification of the different veins as of one age or the other; so in the cross-examination the temptation was too strong for Mr. Gray to resist referring to the book. Mr. Emmons proved equal to the occasion, however, and answered Mr. Gray that in a book like this, devoting only a few pages to a general description of a district, the big important features only were treated, and he could hardly be expected to describe such insignificant veins as the '699' and Carlisle. The witness followed through the development openings and showed how in his opinion the plaintiff had utilized veins of different ages to establish continuity and likened some of their raises to highly inclined crosscuts.

The other witnesses in their testimony followed the same general trend. The branches that make up the '699' and Carlisle veins on the Elm Orlu exhibits were colored red; and the same veins on the Butte & Superior maps, blue. This blue coloring indicated north-west veins and more closely approached the interpretations of age relationship as shown by the maps used in the first trial.

After eleven witnesses had been heard the color carried mentally by an impartial observer was a hazy purple. One thing was apparent. The so-called 21 branch of the Pyle vein was of Rainbow age and did not continue east of the 301-ft. plane. Testimony and actual development showed that it crossed the common side-line 186 ft. beyond the decreed plane. Where 4A is marked on the map, the plaintiffs contend it swings south-easterly into the Elm Orlu claim again, but the defence maintained this was a vein of later age that cut the '21' vein. No matter now, however: the suit was settled on the 21 showings.

The Butte & Superior company granted the Elm Orlu the 186 ft. additional eastward extension of the ownership of the Rainbow vein below a horizontal plane, the elevation of which is 4859.50 ft. above sea-level, or in terms of mine workings, the third floor of the 1200 Black Rock. This was called, by the plaintiff, the junction drift. Furthermore, the Butte & Superior company gives to the Elm Orlu company the ownership of the Jersey Blue vein westward of this new 487-ft. plane to the west end-line of the Jersey Blue claim, below a sea-level elevation of 4740 ft., or the general elevation of the 1300 Black Rock. In return, the Elm Orlu company returns to the Butte & Superior company the $314,450 that was put up by them as settlement of the first trial.

What the settlement will cost the Butte & Superior is not known definitely. That there was a payment in money is strongly suggested in the decree as signed by both parties and the Court, for it says: "By the way of supplemental and final decree, it is further ordered, adjudged and decreed that as the parties have settled all money claims as between themselves, therefore, etc." This, in connection with persistent rumor, would indicate that some money consideration played its part. Two and a half million dollars is the sum mentioned.

The preparation for this suit and the three weeks of hearing represent a vast amount of work and the cost in money runs up to a large sum. Witnesses and attorneys gathered in Butte from Los Angeles, San Francisco, Seattle, Wallace, Minneapolis, Madison, and New York. The testimony as transcribed makes 17 volumes of 235 pages each.

EXPERIMENTS on the recovery of tungsten from concentrates have been made by H. W. Hutchin and L. J. Meade, who found that a strong solution of caustic soda acting on uncalcined material effected a complete extraction of WO_3. Calcining the concentrate first rendered the extraction incomplete. Dilute solutions of caustic soda were ineffective. The economic success of the process, however, appears doubtful, and further experiments have therefore been suspended.

Diesel Engines in Mine Power-Plants

By C. LEGRAND

Late in 1912 the Phelps Dodge Corporation decided to test engines of the Diesel type in practical service under the conditions existing in mine power-plants. Engines of fairly large capacity were not then made in this country, so that two engines were ordered from Belgium in 1913. Owing to delay in shipment, the first engine was not put in service until December 1914, and the second in about March 1915. These engines were installed at the Burro Mountain branch of the Phelps Dodge Corporation, at Tyrone, New Mexico, at an elevation of 5950 ft. above sea-level.

The engines are of the vertical two-cycle type, with five cylinders, 20.6 in. diameter and 26 in. stroke, running at 180 r.p.m., and rated at 1250 b-hp. at sea-level. The engines have water-cooled pistons, cross-head slides, cylinder heads, and exhaust-pipes. They are equipped with cross heads instead of the more usual trunk-pistons. This increases the cost of the engine, but was considered justifiable from the operating point of view.

The fuel is injected into the cylinders by compressed air, and the air-compressor for this work is direct connected to the engine. The same compressor furnishes compressed air for starting the engine, this air being stored in two air-bottles under a pressure of 1000 to 1100 lb. per square inch. The fuel-oil has to be filtered before being used, as sand is very destructive to the fuel-pump valves, which work under pressure up to 1000 lb. per square inch.

The scavenging pump is sufficiently large to maintain a pressure of two or three pounds in the cylinders of the engine at the beginning of the stroke, and in this way restores approximately sea-level conditions of pressure in the cylinders, giving the same power to the engine less the extra work performed in the scavenging pump. The initial pressure in the cylinders is varied accordingly with the barometric pressure at the point where the engines are used. This method increases the fuel consumption per available horse-power, but unless the fuel-oil cost is very high, it gives a cheaper total cost if the decreased investment is taken into consideration.

Although the two-cycle engine has a higher fuel consumption than the four-cycle engine, the cost per horse-power of engine installed is less; it eliminates the exhaust-valve, which is a source of trouble, especially with oil containing sulphur, and replaces this valve by the scavenging valves, which handle only clean air instead of hot gases. The two-cycle engine is more complicated and probably has a higher repair cost than the four-cycle engine, although it is difficult to obtain figures on comparable operating conditions and sizes of engines. It is also difficult to get information on the relative reliability of the two types of engines and on what percentage of the time they are fit for service, but there is no doubt that with both types it is necessary to have spare units to attend properly to the maintenance of the engines if continuous service is needed.

The service given by the first two engines was satisfactory, and two additional engines, built in this country, were put in at the plant of the Burro Mountain branch, two at the plant of the Morenci branch at Morenci, Arizona, and a third one is being installed at this plant, one at the Old Dominion Co.'s plant at Globe, Arizona, and two at the Moctezuma Copper Co.'s plant, at Nacozari, in Sonora, Mexico. All of the above are direct-connected to 60-cycle alternators of 815 to 850 k.v.a. capacity. In addition, an air-compressor of 4000 cu. ft. per minute capacity, driven by a three-cylinder engine with the same size cylinders as the five-cylinder engines, has been running at the plant of the Burro Mountain branch for the last 18 months, and a 6400 cu. ft. air-compressor, direct-connected to a five-cylinder engine, should be running in Morenci by the end of August.

On these compressors the speed of the unit is controlled by the air-pressure, and on the one in service there is no difficulty in getting an automatic range of speed from one half to full speed—the full speed being 180 r.p.m.

The running of the compressor units has been satisfactory, as is shown by the cost of compressed air. For the whole year 1918 the costs at various plants of the Phelps Dodge Corporation, per million cubic feet of free air compressed to 90 lb. gauge, figured on equal cost of fuel and water, were as follows:

Bisbee plant (output 5913 million cubic feet)	$ [illegible]
Globe plant (output 2986 million cubic feet)	[illegible]
Tyrone plant (output 860 million cubic feet)	[illegible]

Year 1919 (four months with increased fuel costs):

Bisbee plant (output 1804 million cubic feet)	$ [illegible]
Globe plant (output 664 million cubic feet)	[illegible]
Tyrone plant (output 464 million cubic feet)	15.53

These costs are running costs, and do not include taxes or general expenses, but they include supervision as well as labor, fuel, lubricating oils, repairs to complete plant, supplies, water, and lighting.

The Bisbee compressors are 7000 cu. ft. units, driven by triple-expansion Corliss condensing steam-engines, using superheated steam, and have a steady load, as we have a hydrostatic air-storage to equalize the demand on the power-plant. At times we have to use 3500 cu. ft. compressors driven by Corliss compound-condensing steam-engines.

The Globe compressors are all driven by cross-compound Corliss condensing steam-engines, using super-

heated steam, and varying in size from 2000 to 5000 cu. ft. per minute. Both plants have boilers equipped with economizers, and use oil as fuel.

The apparent anomaly of reduced costs at the Tyrone plant with increased cost of fuel is due to the increased output as well as the decreased general repairs to the plant. The total charge for labor on the plant is divided proportionately to the number of cylinder hours of service of the compressor and power engines, and not to the power delivered, so that with a larger output of air the labor charge per 1000 cu. ft. diminishes. In our steam-plants the labor is divided among various engines in proportion to the steam used. To make the two figures absolutely comparative, we should charge the labor on Diesel engines in proportion to the fuel used. This would decrease the cost of air at Tyrone in 1918, and increase it slightly for 1919. The cost of labor at the Tyrone plant was $5.02 per million cubic feet in 1918, and $3.70 in 1919.

The fuel-oil used in our Diesel engines is the same as we use for the boilers in steam-plants. It has varied in gravity from 14 to 20°B., and at times has contained over 2% of sulphur. The oil has to be heated so as to flow freely in the fuel-pumps and go through the filter. This is done by means of the circulating water of the exhaust-pipes, as the temperature of this water can be varied without danger to the engines.

A few minutes before shutting down an engine, the fuel-oil is changed to a 24°B. oil, so that the fuel-pump piping is completely filled with light oil before the engine stops. In starting, the same oil is used until the heavy oil has time to warm up. No adjustments on the engine are necessary when changing fuel-oil.

The result of our experience is that repair costs are heavy and are a large part of the running costs. These repair costs can be divided into two classes: those which consist of regular inspection and renewal of parts to avoid trouble when the engine is in service, and those which happen at irregular intervals regardless of the attention given to the engine.

In the first class I would place the piston-rings, the scavenging valves, the atomizers, the air-compressor valves, the water-connections for piston-cooling, the mechanical adjustments of bearings, gears, etc. In the second class, the head cracking, piston cracking, cylinder-liner cracking, and unforeseen accidents.

The regular and conscientious inspection of the various parts of the engine at fixed intervals, to be determined by experience, renders the engine reliable in service. The easiest way to care for the inspection of such parts as atomizers, scavenging and air-compressor valves, is to replace them by duplicate parts and put the parts removed in first-class shape to go back on the engine at the next examination. Our experience shows that it is cheaper to do this examination than to wait until a part gives trouble, as when this happens there is usually a sudden and costly shut-down, and the troublesome part has to go to the scrap-heap.

The condition of the piston-rings can be determined by indicating the engine, and if compression begins to fall, immediate attention should be given to the piston-rings. Once the engine is down to its bearings, a fall of compression is due to faulty piston-rings, or to the cracking of a head or piston. Leaks in valves will burn them out in a few minutes, and show themselves forcibly to the attention of the operator.

The scavenging valves have given no trouble when inspected and ground every two months. It may be possible to extend this to a longer period, as we have operated some of them over six months without attention, but we prefer to keep on the side of safety.

With oil properly filtered, the fuel-pump valves do not give much trouble. They should be re-ground and kept in first-class shape. The intervals between grinding depends mostly on the cleanliness of the oil.

The gears driving the cam-shaft gave some trouble in the first engines, but they are now satisfactory and do not require frequent adjustment.

The greatest cause of trouble has been the air-compressor valves. The Belgian design was a balanced poppet valve, mounted between two springs. These were satisfactory, but required careful adjustment, and during the War we found it impossible to get springs that would stand the work. These valves have now been replaced by plate valves. We still have some trouble in getting suitable material for the valve-plates, but this should now be obviated.

The main bearings have given no trouble, and they are not adjustable for wear.

The crank-bearings and cross-head shoes require less attention than they do on a steam-engine, as they are of generous size.

The water-cooling system gives little trouble, but care must be exercised in erecting the connections for water-cooling of pistons, to ensure that the water is delivered at the proper point in the piston. The water used for circulation should have as little scale-forming matter as possible, as a little scale will reduce the life of heads and pistons considerably. In most localities the water should be treated, and where cooling-towers are used, a certain amount of the water should be wasted to prevent concentration of salts in the circulating water.

The greatest source of expense for repairs has been the cracking of the heads, although this causes practically no interruption of service. The heads crack when the engine is stopping, and if the cracks are not large enough to prevent the engine starting, through loss of compression, they take up in a few minutes after load is put on. However, we found it inadvisable to keep cracked heads in service if they leak water in the cylinders when the engine is not running, as the rust formed on the cylinder-walls wears them out rapidly. Water cannot leak into the cylinder when running, as the inside pressure is always greater than the water-pressure. The cost of head repairs has been considerably reduced by making the head in two parts, and will be further reduced by getting the proper material for the portion exposed to the heat. We have as yet not obtained, in this

country, heads that stood as well as the original heads on the Belgian engines.

The cracking of the piston is not so serious, and can usually be traced to some defect in the water-cooling system or defective castings.

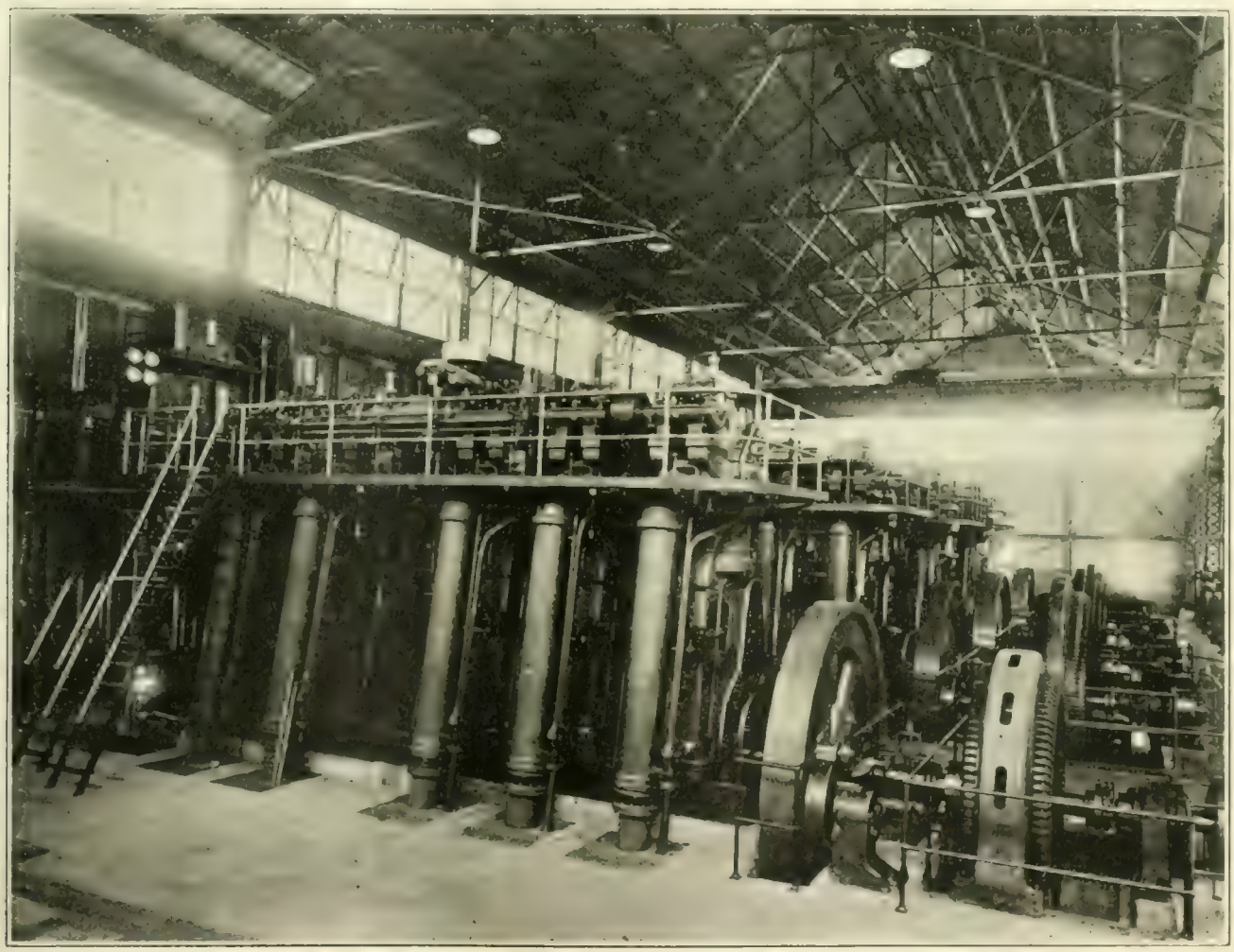
The fuel consumption of the engines under test conditions is shown in the appended curve. The actual consumption does not vary more than 2 or 3% from that shown, even with variable load. The only time fuel consumption increases is when engines are allowed to run with leaky piston-rings, so it is advisable to keep daily records of fuel consumption.

The consumption of lubricating oil varies from 5 to 6 gallons of cylinder-oil per 24 hours, and is practically independent of the load. This oil consumption is the total oil used on the engine, and includes bearing lubrication, for which we use the same oil as for cylinders. At the Tyrone plant we use machine-oil for bearing lubrication, but the quantity needed is greater and it does not decrease the cost of lubrication.

We gained our experience at the Tyrone plant, and the cost of this experience is reflected in the repair cost to the plant, which averaged $28.50 per kilowatt-year available (available kilowatts are the total generated less power taken for auxiliaries and lighting of plant) since the plant was started. The same cost at Morenci for the first five months of this year has been $11.25, and this I expect can be maintained through a period of years if we can obtain a better load-factor on the engines and after we have a spare engine.

The operating data on the Morenci plant for the first five months of this year follow: (The month of August 1918 is added to show the effect of load factor on plant efficiency).

	August 1918	1st 5 months 1919
Rating of engine	800 kw	800 kw
Average load on plant	701 kw	708 kw
Average load per engine (based on running time)	692 kw	656 kw
Load-factor	86.5%	82.3%
Average load for auxiliaries	11.1 kw	14.5 kw
Average load available	681.6 kw	642.5 kw
Pounds fuel-oil per kw-hr. generated	0.681	0.708
Pounds fuel-oil per kw-hr. available	0.694	0.708
Kilowatt-hours available per bbl. of oil (42 gals.)	468	465
Lubricating oil per engine hour	0.216 gal.	0.241 gal.
Cost per available kw-year		$29.319



THE DIESEL ENGINE IN USE AT TYRONE, NEW MEXICO

Divided as follows:

Supplies (includes lubricating oil)	$3.324
Water (15½c. per 1000 gal.)	0.820
Fuel-oil	62.362
Repairs	11.255
Proportion at power house:	
Labor	13.583
Supplies	0.488
Telephones	0.154
Hauling	0.059
Repairs	2.013
Fire insurance	0.132
Sundries	0.129

In these costs the operating labor includes a proportion of the master mechanic's salary. Repairs include all material and labor; the shop labor includes overhead charges for supervision. The proportion of power house repairs includes all repairs to buildings and general equipment not used exclusively by Diesel engines.

In analyzing these costs and comparing them with steam-plant costs, the load conditions have to be taken into consideration. On Sundays the average load is about 100 kw., while on week days we have peaks lasting several hours with over 1200 kw. load.

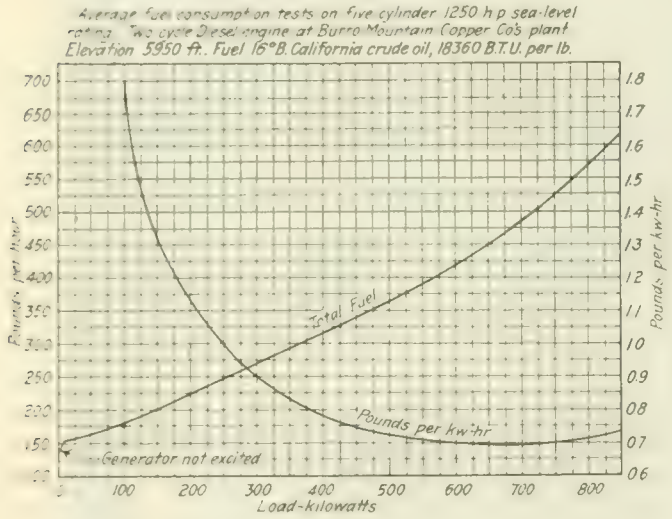
Comparing this plant with a turbine plant that would handle the same load, there would be a reduction of the cost of supplies, although this would be small, as the boiler-room supplies would have to be included.

The water would cost approximately five times as much.

The fuel-oil 2¼ to 2½ times as much.

The repairs would be reduced to about one-third.

The operating labor would be a stand-off.



In conclusion, I am of the opinion that for plants of moderate capacity, and where fuel is expensive, the Diesel engine has a good field, but it is necessary to handle it with due regard to its limitations.

The above information is given through the courtesy of the Phelps Dodge Corporation, which allowed its publication.

Inspiration Copper Co. has been able to effect a somewhat lower production cost than prevailed last year, due to the wage cut of six months ago and lower prices for materials. The company did not earn, however, in the past six months the dividends paid. With a monthly yield of 6,000,000 lb. of copper, Inspiration has been running about one-half capacity. It has been exceedingly difficult to get sufficient men in Arizona and much of the available labor has been inefficient. An experimental plant for treating oxidized ores, of which Inspiration has a considerable tonnage, has been completed. The latest estimates indicated that the company had 17,500,000 tons of ore averaging 1.31% copper. This material will be tried in a leaching process. If successful, an addition to the equipment will be made. At the beginning of the year Inspiration had on hand 28,000,000 lb. of unsold copper, but recent sales have cut into this.

Future of the Belgian Zinc Industry

The Bureau of Mines has published a special report on the zinc industry in Belgium, by March F. Chase. The principal reason for the smelting of zinc ores in Belgium, before the War, was the fact that the country had an abundance of cheap skilled labor, the proper quality of clay for retorts, cheap coal, and cheap water transportation. Of these four factors, probably the most important was labor. The past four and a half years of enforced idleness, together with the removal of many of the workers from towns near the smelting plants, has resulted in a thorough disorganization and demoralization of labor, and its effects will be felt for some time in the industry, both in the efficiency of the operations and in the cost. The future of Belgium as a zinc-producing country is not particularly bright, but the relative position it will occupy from now on is not easily predicted. It is rather certain that for some years to come production will be far below pre-war figures and may never reach the 1913 level. The rehabilitation of the industry, even to a limited extent, will depend upon the obtaining of prompt and reasonable supplies of ore. If these are not promptly provided, the greatest asset that Belgium had—that is, the skilled workmen—will be lost, as these men undoubtedly will seek employment either in other countries or in other industries. The smelting capacity outside of Belgium has been so vastly increased that it can easily take care of the world's requirements, and the only Belgian plants that can hope to compete successfully are those that are in a position to operate on low cost and high recovery. The present cost of coal will no doubt come down, but the political and commercial control of the primary raw material, being outside of Belgium, will always work against the continuance of the industry. One factor that will be helpful, however, will be a profitable market for the by-products. This may compensate to a considerable extent for the disadvantages under which the industry will otherwise be in its efforts to rehabilitate itself. Aside from commercial considerations, the present physical condition of the plants will tend to retard the resumption of operations. During the last two years of the occupation, the idle plants suffered largely through lack of maintenance, and from equipment of all kinds being removed. Naturally there was some distinction made in the character of material removed from the plants that were German owned, and those owned by Belgians. The former operated to a limited extent during the entire period of occupation and are in fair shape to resume work on an extensive scale. The Belgian engineers have contributed largely to the metallurgy of zinc, and although they are now handicapped in many ways, it is entirely possible that they will be able to meet the situation and restore the industry to a fair proportion of what it was before the War.

A Federal Department of Public Works

Text of the bill (Senate 2232) to create such a department and to define its powers and duties.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled:

SECTION 1. That the name of the executive department now designated as "Department of the Interior" be changed to the name "Department of Public Works", and that the head thereof shall continue to be a member of the Cabinet under the official designation "Secretary of Public Works", to be chosen and confirmed as in such case now provided by law, except that when the present occupant shall vacate that office all subsequent occupants shall by training and experience be qualified to administer the affairs of the Department and to evaluate the technical principles and operations involved in the work thereof.

SECTION 2. That all the powers, functions and duties, executive and administrative staff, personnel and property, and all bureaus and other instrumentalities now vested in, a part of, or belonging or subordinate to, the Department of the Interior, be in like manner and to the same extent continued in the Department of Public Works, except as hereinafter provided.

SECTION 3. That the following bureaus and other instrumentalities now subordinate to the Department of the Interior shall, with all their functions, personnel and property and all boards, commissions, or agencies pertaining thereto, be transferred as herein specified:

A. The Patent Office to the Department of Commerce.

B. The Bureau of Pensions to the Department of the Treasury.

C. The Bureau of Education to the Department of Labor.

D. The Bureau of Indian Affairs and the Board of Indian Commissioners to the Department of Labor. PROVIDED: That the engineering and construction work and the land and mineral surveys now performed by, or under the direction of, the Bureau of Indian Affairs shall be prosecuted under the Department of Public Works.

E. The St. Elizabeths Hospital and the Freedmans Hospital, to the Public Health Service, Department of the Treasury.

F. The Columbia Institution for the Deaf and the Howard University, to the Bureau of Education, Department of Labor.

SECTION 4. That the following bureaus and other instrumentalities now subordinate to the departments in each case designated, with all their functions, personnel and property, and all boards, commissions or agencies pertaining there to be transferred to the Department of Public Works:

A. The Supervising Architects Office, now subordinate to the Department of the Treasury.

B. The Construction Division of the United States Army, River and Harbor Improvements, the Mississippi River Commission and the California Debris Commission, now subordinate to the Department of War, PROVIDED: That the engineer officers of the United States Army detailed to the non-military duties having to do with River and Harbor Improvements, the Mississippi River Commission, and the California Debris Commission, shall be detailed by the Secretary of War to like duties under the Department of Public Works for such period, not exceeding two years, as the Secretary of Public Works may find necessary to make gradual transfer of said improvements and instrumentalities to civil administration without detriment to the public interest; that upon such transfer to civil administration, said engineer officers of the United States Army shall be returned to military duties, and PROVIDED FURTHER: That for the purpose of acquiring instruction, training and experience, members of the Corps of Engineers, United States Army may, with the consent and approval of the Secretary of Public Works, be detailed by the Secretary of War for temporary duty under the Department of Public Works and shall be assigned by the Secretary of Public Works to such duties as may be deemed best adapted to the purposes of such detail.

C. The Coast and Geodetic Survey, and the Bureau of Standards, now subordinate to the Department of Commerce.

D. The Bureau of Public Roads and the Forest Service, now subordinate to the Department of Agriculture.

SECTION 5. That all officers of the United States Army attached to the Department of Public Works shall retain their military rank and succession and receive the compensation, commutation and emoluments provided by law in the case of Army officers of the same rank not detached from regular army service.

SECTION 6. That pending further action by Congress all personnel, appointments, tenure and compensation under the Department of Public Works shall, except as otherwise provided herein, continue under the laws now in force in the several bureaus and other instrumentalities retained in or transferred to said department under this Act.

SECTION 7. That there shall be four Assistant Secretaries of Public Works appointed by the President with the advice and consent of the Senate, each of whom shall be specially qualified by training and experience for the particular services over which he may have jurisdiction, and who shall be removed from office only for inefficiency and for conduct detrimental to the service, on charges duly made and adjudicated in accordance with law in such case provided, or for age or physical or mental impairment, and that each of said Assistant Secretaries shall be paid a compensation of $7500 per annum; that said Assistant Secretaries of Public Works shall be included within the scope of any civil service retirement laws now or hereafter enacted by Congress and the regulations thereunder; that one Assistant Secretary shall have administrative jurisdiction over all matters of en-

gineering design and construction, by whatever bureau or other instrumentality of the Department performed; that one Assistant Secretary shall have administrative jurisdiction over all architectural work and construction, by whatever bureau or other instrumentality of the Department performed; that one Assistant Secretary shall have administrative jurisdiction over all scientific work and surveys, by whatever bureau or other instrumentality of the Department performed; that one Assistant Secretary shall have administrative jurisdiction over all land and legal matters, by whatever bureau or other instrumentality of the Department performed; that said four Assistant Secretaries shall, under the direction of the Secretary of Public Works, co-ordinate and bring into efficient relation all of the functions included in this section to the end that the work of the Department shall be harmoniously and most economically performed and administered.

SECTION 8. That all acts or parts of acts inconsistent with the terms of this Act are hereby repealed, and the Secretary of Public Works is authorized to perform any and all such acts and to make such rules and regulations as may be necessary and proper for the purpose of carrying the provisions of this Act into full force and effect.

Mining in Nevada in 1919

The high price of silver and the discovery of rich gold-silver ore in the Divide region, in Esmeralda county, have added materially to the interest in mining in Nevada. It is not probable, however, that the output of gold and silver in 1918 will be exceeded in 1919, and it is nearly certain that the output of copper, lead, and zinc will be much less.

GOLD. Gold is found in all the counties of the State, but most of the output comes from mines in Esmeralda and Nye counties. The output from the Goldfield district, formerly the largest producer, has been rapidly growing less from year to year. The production in 1917 was $1,900,082, and in 1918 it was only about 60% of that amount. In 1919 the Goldfield Consolidated is being worked by a leasing company, and rich ore has been opened in the Florence mine. The output of gold from Tonopah is not decreasing so rapidly. The district was credited with $1,539,529 in 1917 and about 80% of that amount in 1918. There was some improvement in the production of gold from the Comstock region in 1918 over 1917, and it is hoped that the total will be upheld in 1919, for the price for the associated silver is much better. In Elko county the Elko Prince continues to be an important producer, and the Elkoro mine, at Jarbidge, became a large producer in 1918, and has prospects of a greater yield in 1919. In Mineral county the Olympic and Aurora mines were productive, but the Aurora was closed at the end of 1918. Much gold comes from the copper ore of the Nevada Consolidated property at Ely, but the shipments from this source were curtailed in the first half of 1919.

SILVER.—The output of silver in Nevada has been decreasing during the last few years. In 1917 it was 11,269,969 oz. and in 1918 about a million ounces less. Mines of the Tonopah district produced 8,734,726 oz. in 1916, 7,068,737 oz. in 1917, and about 6,000,000 oz. in 1918. The Tonopah-Belmont, West End, and Tonopah Extension mines are maintaining good production, but the shipments from the district indicate a general decrease. The shipments from the Comstock district may improve somewhat in 1919, as rich ore has been opened at depth. The mines at Rochester produced 799,871 oz. of silver in 1917 and slightly more in 1918. There has been a decided boom at Divide, where much ore similar to that at Tonopah has been developed. It is hoped that this discovery may in the future offset the decreasing gold and silver production of other districts in Nevada. At present from 200 to 400 tons of milling ore is being shipped each week.

COPPER. The production of copper in Nevada was 122,794,704 lb. in 1917 and about 105,000,000 lb. in 1918. There will be a decided decrease in the output of copper in 1919, as the Mason Valley smelter was closed in February and the Nevada Consolidated Co. curtailed its output about 30%. The Mason Valley plant produced about 1,300,000 lb. per month in 1918, and only 1,000,000 lb. per month in January and February 1919. The output of copper of the Nevada Consolidated was reduced from 6,000,000 lb. per month in 1918 to less than 4,000,000 lb. per month in 1919. The shipments from the Yerington and Santa Fe districts were also greatly reduced.

LEAD AND ZINC. The output of lead in Nevada decreased from 27,677,928 lb. in 1917 to about 21,000,000 lb. in 1918. As the price of lead is reduced and the shipments from the Yellowpine district are smaller there will probably be a decrease in the total for 1919. Heavy shipments continue from the Prince Consolidated mine, at Pioche, in Lincoln county, and the Virginia Louise has become a considerable producer. The output of zinc decreased from 23,307,868 lb. in 1917 to about 15,000,000 lb. in 1918. Most of the ore containing zinc comes from the Yellowpine district, where shipments of both lead ore and zinc ore are only about half those of 1918. Zinc concentrates were stored at the Yellowpine property and new machinery was being placed in the mill building. The Potosi mine, near Arden, produced several thousand tons of zinc ore in 1918, but reduced its shipments about 60% during the first six months of 1919. In 1917 the district produced, aside from other metals, 9,298,706 lb. of lead and 20,535,768 lb. of zinc. In 1918 these totals were reduced to about 5,751,000 lb. of lead and 15,351,000 lb. of zinc.

In the early part of 1919 dividends from Nevada mines were declared by the Nevada Consolidated, Tonopah Belmont, Tonopah Extension, and West End companies.—V. C. Heikes, U. S. Geological Survey.

PLATINUM in Rhodesia occurs in the Somabula diamond-bearing gravels. These are found almost on the main watershed of Southern Rhodesia, about 12 miles south-west of Gwelo. The pebbles also contain chromite.

CALIFORNIA

CARSON HILL GOLD MINES. MINT WORKERS PROTECTIVE LEAGUE. GENERAL NEWS OF NEVADA COUNTY.

CALAVERAS COUNTY.—Interesting results are being obtained by the Carson Hill Gold Mines, Incorporated, properties, in operations started under war conditions and still operating under the adverse conditions resulting from the War. The ore is mined at the Morgan mine at Carson Hill and transported about three miles over the railroad of the Sierra Railway Company of California to the mill of the Carson Hill company at Melones. This mill consists of twenty 1250-lb. stamps followed by two 8-ft. Hardinge pebble mills, Deister concentrating tables, and a cyanide plant for the treatment of sand, slime, and concentrate. The tonnage treated from January 1 to July 31 is as follows:

	Tons
January	1964
February	3424
March	5332
April	6144
May	6509
June	6843
July	6930

The cost per ton for the above, divided into two periods, is as follows:

	June	Average 6 months	July	Average 7 months
Ore extraction, per ton	1.702	1.819	1.635	1.785
Milling, per ton	1.142	1.324	1.128	1.287
Marketing, per ton	1.126	1.188	1.110	1.174
General expense, per ton	0.638	0.805	0.752	0.795
Total operating	4.608	5.136	4.625	5.041
Development, per ton	0.784	0.648	0.414	0.604
Total operating and development	5.392	5.784	5.039	6.645

GRASS VALLEY.—At a special meeting of the Mine Workers' Protective League on September 4, a motion was carried to enforce the League rules throughout the district, but to use conciliatory methods as far as possible. The mine-owners take no interest in the new order of things—at least outwardly. New workers are to be allowed one pay-day before affiliation and 15 days' grace should 'persuasion' be found necessary. At the end of that time the committee "would take such action as the circumstances demand." Occasionally a new man is found who does not take kindly to voluntary membership. What course will be pursued with unruly members has not yet been made public. The paid membership is now between 900 and 1000. The primary cause of the strike in June last was given as the high cost of supplies in Grass Valley. These are now about the same to the single man as formerly. High living costs brought about demands for other working conditions, and a compromise agreement was finally adopted, the principal feature of which was a mine-operated store where goods were to be sold at cost. Since returning to work one hears nothing but 'time' and 'wages'; there has been nothing done toward maintaining a goods-at-cost store. No protest has yet been made by the men or by the League as a body. It is only conjecture whether anything will be done at all; but in solidifying the organization by insisting on every worker becoming a member, almost summary proceedings are taken. It is not unlikely that when the League has its full membership other demands will be made more unreasonable than the last. With a large income from dues the League must soon be in a position financially to enfore its demands or close down the mines entirely. The majority of the family men were against the June strike but were easily outvoted and what course they would pursue in the event of another strike can only be guessed. With a full treasury and changing conditions they would undoubtedly follow their officials. The League is accountable to no other organizations and so has a free hand.

The Golden Center Mining Co., operating in the heart of Grass Valley, which has been brought into prominence of late through its application for a mineral patent within the town-site, closed down September 5. The action was not unexpected in the light of recent statements made by the officials of the company. Some 25 men are thus thrown out of employment. The mine will remain closed as long as the present high costs continue. The ore on the 500-ft. level is stated to mill about $18 per ton, and the recent discovery on the 1100-ft. level has proved a body of $40 ore to extend from the 800-ft. line to the 1100-ft. There was a heavy flow of water at the lowest level, practically forcing an abandonment of that portion of the mine. The Golden Center has had somewhat of a spectacular career. At the beginning of operations several dividends were declared from high-grade ore and a great deal of specimen ore was produced; but no surplus fund was created, and when threatened with a continuation of high costs and labor troubles, coupled with a light pumping plant, closing down was all that could be done. The mine has paid about $500,000 in dividends and at the late meeting the stockholders authorized the sale of 187,000 shares of treasury stock at $1 per share to create a fund for the purchase of new machinery when operations are resumed.

William F. Bawden has bonded the 30-acre ranch of Thomas Geach. The bond runs for two years. Bawden did considerable work on a former bond and will recommence active prospecting immediately. There are

two tunnels, one 200 and the other 330 ft. long, with a winze 70 ft. deep. There are some well-defined veins running through the property, which is close to producing mines. The work of unwatering the Idaho-Maryland shaft will commence within two weeks, the delay having been caused by the failure of necessary machinery to arrive. E. M. Taylor, manager of the Signal mine, is doing extensive prospecting on the 200-ft. level with encouraging results. The first water was raised at the new Alcalde, formerly the Kenosha, on August 31, and the work of draining the mine is expected to proceed rapidly. George F. Taylor of Downieville has charge of a gang of 40 men who are rushing foundation work on the new concrete dam at Bullard's Bar, with the object of completing that portion of the work before the winter rains set in.

NEVADA COUNTY.—The Gaston mine near Washington has shut-down until spring, or until such time as labor may be depended upon. The company has been under a heavy expense for a number of months in repairing the surface plant and placing the mine in a condition to produce. From 30 to 40 men have been employed. The company lost one mill and other surface improvements by a fire a few months ago. The old Delhi mine, Columbia Hill, and some dozen adjoining claims under bond to A. A. Codd of Reno, Nevada, is being advertised by the sheriff to satisfy a judgment obtained by the heirs of Louis Nonnenmann of San Francisco to recover approximately $40,000. The corporation under the Codd bond has been known as the Consolidated St. Gothard Gold Mining Co., and, aside from the claims, included water rights and easements. A. W. Hoge, superintendent of the California Mining Co., is building a 15-stamp mill at Willow Valley, three miles from Nevada City, in preparation for encountering the cemented gravel known to exist in the company's holdings and a portion of Harmony Ridge, famous as a gold producer many years ago. The channel has been worked on each side of this company's land and a tunnel now over 800 ft. long has been run toward the gravel at a heavy expense.

SIERRA COUNTY.—A. Siebert of San Francisco is looking over the Primrose quartz claim in Hog canyon, where he is having development work done. The long tunnel being driven to tap the gravel in the Gibraltar mine at Poker Flat will not be complete until next spring.

NEVADA

GOLDFIELD.—MINERAL COUNTY.—GEOLOGY OF TULE CANYON AND PRESENT OPERATIONS.

GOLDFIELD.—The winze from the 320-ft. level of the Cracker Jack is 100 ft. deep and a station is being cut preliminary to cross-cutting to the vein, which is estimated to be 50 ft. distant. The vein, when cut from the 60-ft. point in the winze, was found to be 28 ft. wide, with 8 ft. of ore averaging $25 per ton. This work is the most interesting in the Goldfield district at the present time, as it is being done far north of what has been generally recognized as the limit of the orebodies. Sinking the winze 40 ft. will give an additional depth of 100 ft. on the dip of the vein. An ore-shoot from three inches to two feet wide has been drifted on for 30 ft. from the east cross-cut on the 910-ft. level of the Spearhead. The grade of ore is described by the management as "fairly good". From 18 in. to 2 ft. of ore assaying 127 oz. in silver has been opened by the West Divide Mining Co. in a 15-ft. drift from the bottom of a 60-ft. shaft. Driving was started in a three-inch seam, which

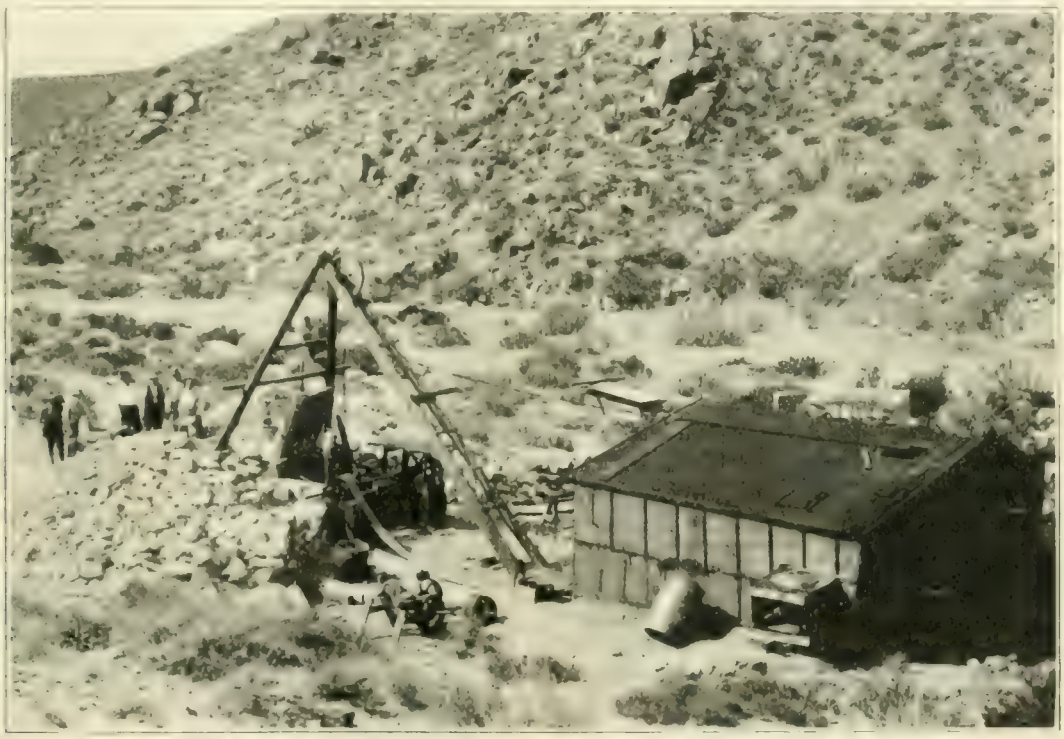
TULE CANYON, NEVADA: THE FLOW INTO THE SLUICES

has widened to 18 in. at the top of the drift and to 2 ft. at the bottom. This is the only work being done in the West Divide district, 10 miles from the main Divide.

Mineral County.—The east drift on the 280-ft. level of the Jumbo Copper Mountain company, north-east of Luning in Mineral county, has attained a length of 630 ft. At 365 ft. this drift entered the downward extension of the Fox lease orebody and continued in ore of mill grade for 150 ft., according to J. K. Turner, consulting engineer for the company. It is now entering the downward extension of the No. 1, or Lapatt lease orebody, which produced $60,000 from above the 80-ft. level. The west drift is 150 ft. long and is being continued to open orebodies developed nearer the surface by lessees. The Jumbo Copper Mountain company, which is controlled by the stockholders of the Jumbo Extension of Goldfield, has been developed continuously since it was taken over by the Goldfield company 26 months ago. The production, including ore shipped previous to July, 1917, has been over $100,000 and over 6000 ft. of development work has been done through four shafts, the deepest 305 ft. Both east and west of the shaft the present work is being done on a contact of granite and monzonite, or granite porphyry. It is the intention of the company to continue driving on the 280-ft. level and to grant leases wherever they will not conflict with the work being done on this level. Ore that will pay at the present price for copper will be shipped when found. Laboratory tests to determine a treatment method for a mill which it is planned to erect have been completed satisfactorily and additional tests are now being made on half-ton and ton lots.

Tule Canyon.—Under direction of A. I. D'Arcy, former consulting engineer for the Tonopah Divide and other Wingfield companies and now general manager for the Goldfield Development company, the Tule Canyon Placer Association has sunk a 35-ft. shaft to bedrock and has started cross-cutting to the west side of the canyon. This work is being done under an option on claims near the northern end of the canyon. South of the claims being developed by the Tule Canyon Placer Association the Goldfield-Tule Canyon Placer Mining Co. has sunk a 42-ft. shaft five feet into bedrock, has cross-cut the canyon to provide a sump for the heavy flow of water on bedrock, and has started prospecting for pockets of rich gravel.

Tule canyon has for many years been a problem for placer experts. It is 12 miles long, extending south toward Death valley from Mount Magruder, a heavily eroded mass of limestone and shale known to the placer miners as the 'water mountain' because the water in Tule is believed to originate in and near it. The walls, the bedrock, and the gravel are granite, with seams of slate. The gravel is from 10 to 20 ft. deep for five miles from the upper, or northern, end, and is over 100 ft. deep near the lower end. The gold, showing little wear and worth $16 per ounce at the mint, was deposited from the upper end. Commonly it is found in flakes, practically all of which settle within 20 ft. of the head of the sluices, but in the upper reaches nuggets of fair size have been found. As the lower end is approached the gold gradually becomes smaller and is more difficult to recover. The deposits are supposed to have had their origin in the erosion of a large area extending north from the canyon. From bedrock to the surface for five miles from the head of the canyon the gravel is filled with boulders, some of which weigh hundreds of tons. The surface of the bedrock is fairly smooth, with ridges



PLACER MINING IN TULE CANYON, NEVADA

crossing under the gravel at frequent intervals. Indications are that 12 of these ridges will be found within one and one-half miles on the claims of the Goldfield-Tule Canyon, and one is the present objective of a drift being driven north in the centre of the wash by this company. The ridges form natural riffles and there are some well authenticated instances of early day miners finding from $10,000 to $40,000 worth of gold banked against them above water level, as in no instance is bedrock known to have been reached by them. In winter the water rises 17 ft. above bedrock in the shaft of the Goldfield-Tule Canyon company, and this summer, one of the dryest ever known in the canyon, the average depth was eight feet.

There is only one instance known of comprehensive sampling being done in the canyon and in that work, reported to have been paid for by the Guggenheims, 75 drill holes to water level gave an average return of 10c. per yard. These holes are said to have sampled 160 acres. In recent years a number of companies and individuals have investigated the possibilities of Tule, all with exception of the two organizations now working having in view larger operations than are involved in drift mining. This led to the canyon being turned down by the investigators, either because they considered that the deposits could not be worked economically or because they considered the initial expense to be too great. Five years ago a placer expert, following an examination of the lower half of the canyon, gave it as his opinion that the deposits could be mined successfully with an initial expense of from $500,000 to $1,000,000 for dredging equipment. This part has been variously estimated to contain from 25,000,000 to 50,000,000 cu. yd. of gravel and sand. There is little on which to base such estimates.

The Goldfield-Tule Canyon company is equipped with a 12-hp. hoist and a 500-gal. sand pump placed 22 ft. from the bottom of the shaft. The equipment of the Tule Canyon Association is similar. The work of both is still in the experimental stage. Both are washing gravel averaging over $1 per yard. The Goldfield-Tule Canyon company has found gravel worth as high as $12 per yard and the Association has exposed material assaying as high as $7 in small quantity. Officials of the former estimate they can clear expenses with $1 gravel.

WISCONSIN

REVIEW OF THE ZINC, LEAD, AND PYRITE INDUSTRIES FOR AUGUST.

August has been a bad month for zinc mine operators, the uncertainty of the metal and ore markets complicating a situation already rendered sufficiently difficult by industrial troubles. Threatened railway strikes the first half of the month imposed embargoes on shipments of all kinds, and mining concerns were left without transportation facilities for an entire week and with irregular schedules over the greater part of the month, even after a desultory attempt had been made to re-establish stated schedules. The threatened strike in the steel industry toward the close of the month was an added factor making for caution, and a scarcity of cars developed when demands came for increased shipping facilities to move live-stock and grain to market centres. Large buying interests, which have been out of the field for two months on account of strikes at smelters, were obliged to leave competitors with a free field, and consequently offerings were lower than standard and published quotations. Grasselli Chemical Co. of Cleveland resumed buying high-grade blende the last week of the month, but purchasing was light. Eagle-Picher Co. resumed buying in the Wisconsin field after having purchased the Lanyon Zinc Co.'s smelter, at Hillsboro, Illinois, but here too no very considerable tonnage was obtained. The United Zinc & Smelting Co. established a buying agent in the field and fair offerings gave hope to producers that when market improvements develop this added buying power will again introduce a measure of competitive bidding, to the advantage of zinc mining. Prominent operators interviewed during the month state the belief that no radical changes for the better may be anticipated in the zinc mining industry until industrial and transportation disturbances have been completely restored to a somewhat normal basis. In this belief operations are being conducted most conservatively, the output for the month of August, on zinc ores, being about 50% of actual maximum capacity.

Prices for zinc ore showed declining tendencies all through the month, opening the first week at $50 per ton, base, for premium grade blende, with fancy lots selling at a point about $3 higher. Second grade ore was in fair demand at $47.50 per ton. A sudden drop brought the base on high-grade down to $45. Second grades ruled at the same figure, but instructions to buyers carried the admonishment that prices were quotable to buyers only and where agreements were in effect sellers held an advantage. A gain was made the third week of the month, high grade going to $48 per ton base; seconds, $45 to $47. The premium grades advanced $1 per ton with second grades holding level. The last week of the month saw both high-grade ore and seconds on a par, namely, $46. It was found, on comparisons, that offerings at several points in the field differed, some buyers offering as high as $46 at the same time that others, on an equal zinc assay basis, were offering as low as $42. This added to the confusion in the field, and many sellers admitted they could not gauge the situation. Low-grade producers, that is, producers of ore assaying under 40% zinc, found a poor demand for their product all month. The leading refining plants offered about all the market there was to be found, and they took only enough to offset the reduced output of the larger operating groups. The reserve of zinc ore of all grades showed 6000 tons of unrefined zinc concentrate and about 2000 tons of high-grade separator product.

Lead ore was also given a decisive set-back during the month. Offerings were held at $67.50 at the beginning of the month. The first set-back carried to $65 and the second to $62.50. Then came a reaction, pig-lead hold-

ing firm in the Eastern and local markets, and bids went as high as $65 per ton, assay basis 80% metal. The offerings holding at the close of the month were on a basis of $64 but high-grade material brought the top price at a figure above $65. Sellers were cautious and averse to considering the lead ore market at all. When the embargoes were in effect not a pound was offered for shipment and the total clearance for the month was very light.

There was little carbonate zinc ore shipped out of the Wisconsin field during the month. Shippers of pyrite showed some anxiety to dispose of reserve stocks as soon as prices for commercial sulphuric acid showed an improvement, but freight-rates and a scarcity of cars restricted the amount of this class of ore marketed.

Deliveries of ores were as follows for August:

District	Zinc, lb.	Lead, lb.	Pyrite, lb.
Benton	14,820,000	858,000	1,614,000
Galena	6,146,000	80,000	.....
Livingston	3,602,000	160,000	.....
Shullsburg	2,706,000	168,000	.....
Hazel Green	1,948,000	.....	.....
Cuba City	972,000	296,000	1,426,000
Highland	900,000	.....	.....
Total	31,094,000	1,562,000	3,040,000

Refining plants were actively engaged all month and made a fair record, all drawbacks considered. Shipments were as follows:

	Lb.
Mineral Point Zinc Co.	6,986,000
Wisconsin-Skinner Roasters	5,116,000
National Separators	5,014,000
Zinc Concentrating Co.	566,000
Total	17,682,000

The gross recovery of crude concentrate, at mills, for the month amounted to 15,692 short tons; total net deliveries to smelters, 9277 short tons. The Mineral Point Zinc Co., Wisconsin Zinc Co., and National Zinc Ore Separating Co., received the bulk of the crude concentrate as it came from mills. Refined ores from Mineral Point went to the company's own smelters at Nassau, Illinois; from the Wisconsin Zinc Co. to the American Zinc Co., Hillsboro, Illinois; from the National Separators, in open market to all representative open market buying agencies, in the field.

Exploration work conducted with drills was given fresh impetus during the month and some exceptionally rich ore was found at several points, especially for the larger operating foreign corporations of this field.

ALBERTA

SMOKY RIVER COALFIELD.

Subsequent to an investigation by a select committee of the Senate, the Hon. Arthur Meighen, Minister of Interior, has cancelled a large block of valuable coal leases in the Smoky River district, some 200 miles north of Edmonton. These leases were granted to Mr. Botts, a German-American, in 1912, and $100,000 had been paid on them up to 1917 and a survey had been made for a railway to connect the coalfield with the Grand Trunk Pacific system. In 1918 Mr. Botts failed to make the annual payment on his leases and consequently they have been cancelled. During the investigation, officials of the Geological Survey testified that, so far as is known, this coalfield is the richest in the whole of Canada, and if it is developed and connected with the Grand Trunk Pacific or the Canadian National railway—only about 60 miles of line is required—it would be capable of supplying the needs of the whole of Western Canada. The cancelled leases comprise 18,000 acres, and the area contains seams ranging from 5 to 17 ft. in thickness. It is estimated by the Geological Survey to contain between two and four hundred million tons of coal. The nature of the coal varies from a rich bituminous to a semi-anthracite. The following two typical analyses will give an excellent idea of the quality of the respective varieties:

	Bituminous	Semi-anthracite
Moisture	1.1	0.9
Volatile matter	18.4	13.4
Fixed carbon	74.0	81.7
Ash	6.5	4.0
B.t.u.	14,100	14,706

The area has been withdrawn from location, and it is suggested that the Government should develop it itself either on a national or a royalty basis. It is stated that the connecting link of railway between the coalfield and the Grand Trunk Pacific or the Canadian National railway will be started with the greatest possible speed. The price of coal in Western Canada has risen to such an alarming extent that it is threatening to throttle other industries. Thus, for example, the price of coal in Vancouver and Victoria cities has risen from $7.50 in 1914 to the present price of $11.25. If the Government decides to develop the Smoky River coalfield, as is proposed, it will be done with the view to controlling fuel prices within reasonable limits.

BRITISH COLUMBIA

DOLLY VARDEN SHIPPING. CANADA COPPER CORPORATION.

After a protracted period of idleness, due to litigation, the Dolly Varden mine, recently acquired by the Taylor Mining Co., is once more on the shipping list. The mine is producing about 100 tons of ore per month, and the product is being sent to the Granby company's smelter, at Anyox, for treatment. With regard to the company's railway and the other mines in the district, after a conference between the company's officials, the Alice Arm Commercial Club, and Mr. J. H. King, Minister of Public Work for British Columbia, Mr. Taylor announced that, in regard to shipping custom ore to the water, much would depend on how the railway and equipment behaved during the shipping of the company's own ore, but that if he could possibly see his way clear to face the many complications involved he certainly would help the prospective shippers to the limit of his ability. A five-

ton trial shipment of copper ore from the Regal group, Princeton district, to the Dalziel copper leaching and recovery plant, at Vancouver, yielded 2.4% of copper, of which 93.5% was recovered with a consumption of 1.8 lb. of 66° sulphuric acid per pound of copper recovered. The ore was roasted for eight hours, the product crushed through a 20-mesh screen, and then agitated by compressed air in a solution of 40 lb. acid in 3000 lb. water. A four to eight-foot vein carrying a rich streak of antimonial-lead ore, running 21.6% antimony, 21.5% lead, and 7.4 oz. silver per ton has been struck on the E and M claim, on Cascade creek, Lardeau district. The Nelson School Board proposes to renew its course of lectures and laboratory work for prospectors this winter if a suitable lecturer can be obtained. The course will run from October 1 to March 31. The course was stopped during the War on account of lack of attendance. The Canada Copper Corporation's report shows that the deficit on operations at Greenwood last year amounted to $19,574. The Greenwood mines and smelter were abandoned and the corporation is now bending all its energies to the development of the big copper deposits at Copper Mountain and in the erection of a concentration plant. The output from the Granby company's mines for July totaled 2,637,184 lb. of copper. New wharfs are being built at the Canadian town of Stewart and the U. S. town of Hyder to accommodate shipping from the Salmon and Bear River districts. The roads to the mines in this district are so impossible that shipping can take place only in the winter over snow. The Premier company intends to experiment with motor-sleds; it has a large tonnage ready for shipping.

ONTARIO

OIL COMPANIES OF UNCERTAIN STANDING.—CONDITIONS AT PORCUPINE.—THE STRIKE SITUATIONS AT COBALT AND KIRKLAND LAKE.

TORONTO.—Stock in several Texas oil companies of uncertain standing has been extensively offered for sale by local brokers, who have failed to comply with the law requiring that before shares are offered to the public a company shall file a prospectus containing full information as to the directors, the amount paid for the property, preliminary and promotion expenses, and other details which will indicate the character of the enterprise. The Provincial government has undertaken to protect investors against fraudulent schemes of the 'get-rich-quick' order, and has started prosecutions against several Toronto brokers, two of whom pleaded guilty to the charges laid against them and were fined $400 and $300 and costs respectively.

PORCUPINE.—The continued strikes in the Kirkland Lake and Cobalt camps have improved conditions at Porcupine, where labor is becoming more plentiful. More men are being taken on at the leading producing mines, the staffs of which show a steady improvement in efficiency. The Porcupine Crown has been dewatered and mining operations resumed. Preparations are being made for re-opening the mill during the present month, plenty of ore to keep it running being available. Development work on the Dome Extension is being actively pushed. Three cross-cuts at the 600-ft. level show good ore and a fourth has been started. Preparations are being made for stoping. L. G. Harris, general manager for the North Davidson, has gone to England with the object of interesting British financiers in the enterprise. The company hopes to raise $200,000 to enable the program planned to be carried out. The Anzac has changed the name of the company to the Wakenda in deference to the wishes of some of the war veterans who objected to the commercializing of the name Anzac.

KIRKLAND LAKE.—With the exception of a limited amount of work that is in progress on some of the outlying prospects, mining operations in the camp are at a complete standstill. The striking miners have nearly all left the camp except some who have found employment at road construction at much lower wages than they were obtaining in the mines. A number of the leading mines are making arrangements to remain closed down for the winter. This decision was largely influenced by the high rate of overhead expenses prevailing previous to the strike, which they hope will be considerably reduced by spring. The construction of the new road from Swastika to Kirkland Lake is making satisfactory progress. The Granby-Kirkland, a new company, is operating two claims about one mile north-east from the Tough-Oakes. About 400 ft. of surface trenching has exposed three promising veins varying in width from 3 to 5 ft. A shaft is being sunk. The Kirkland Porphyry, which has very few shareholdes and no creditors, has gone into voluntary liquidation.

COBALT.—The miners' strike is still unsettled, and operations are generally suspended and many of the mines flooded. A visit to this camp was part of the itinerary of the Prince of Wales, and great preparations had been made to give him a fitting reception, including an inspection underground, but his visit has been cancelled on account of the strike. A committee of business men of Cobalt made an attempt last week to effect a settlement, but it was no more successful than former endeavors to bring the parties together. The mine managers have issued a lengthy statement defining their position, reiterating their determination not to recognize the Western Federation of Miners, and accusing the Minister of Labor of unfairness in refusing to accept evidence offered by them as to the objectionable character of that organization. The mine workers have appointed a committee independent of the union, and latest reports indicate that conferences between this committee and the mine managers may perhaps bring about an agreement. The Mining Corporation of Canada has taken over from Campbell & Fairbairn their lease of the Foster mine, which has four years to run. The Nipissing has declared its usual 5% quarterly dividend. The financial statement as of August 23 showed cash in bank, war bonds, ore on hand and in process, and bullion to the amount of $3,863,386.

CONVENTION OF AMERICAN MINING CONGRESS

The convention of the American Mining Congress will be held at St. Louis, Missouri, beginning November 17, and will last from ten days to two weeks. In the last two years, on account of the War, there have been only directors meetings, and it is expected that the present convention will be the largest the American Mining Congress has ever held. Twenty-five hundred mining men are expected to attend. Coal, oil, and all metals, including chrome, manganese, and tungsten, will be discussed. The object of the convention is the stimulation of the mining industry, including the markets upon which it depends. The program of the speakers will be announced later. Bulkeley Wells is president and J. F. Callbreath secretary.

ARIZONA

Oatman.—The United Eastern Mining Co. has declared a dividend of 7c. per share, payable on September 28, to stockholders of record at the close of business on September 8.

CALIFORNIA

Eldorado County.—The Day brothers are getting out, for a test run, a carload of copper ore from the Lady Emma copper mine, 12 miles north-west of Placerville. The ore will be shipped to a reduction plant on San Francisco bay to be tested for recovery and best method of treatment. If it proves profitable shipments will continue to be made. The claim is patented and is owned by W. F. Detert, of San Francisco.——T. A. Murray, who was in Placerville recently from the East Belt of the Mother Lode, reports that active mining operations will be started soon by Omer and L. P. Denny, of San Francisco, on the Rocky Bar River Gravel gold mine, situated on the north bank of the middle fork of the Cosumnes river 14 miles south-east of Placerville. Special mining machinery will be installed. Last winter the Linscott Drilling Co., of San Francisco, drilled five holes with a Keystone churn-drill to a depth of about 60 ft. The sampling showed that a quantity of the gravel contains an average of $9 gold per cu. yd. About a year ago, J. A. Prentiss, who was superintendent of the mine, is said to have recovered over $6000 in gold nuggets from the property within a short time.——Charles Woodburn has given a working lease and bond on the Livingston Deep Gravel gold mine, near the Rocky Bar mine. A new drift tunnel will be run by the lessees to tap an unworked part of the buried river-channel. The property, which is a continuation of the rich Slug Gulch channel, was mined in the early days of the district and a considerable quantity of gravel gold was recovered.

Grass Valley.—Dewatering the North Star mine has been almost completed and mine operations resumed for the first time since the miners' strike last spring brought about flooding of the lower levels.——The workings of the Empire have been cleared beyond the 4300-ft. level. Preparations are being made for resumption of production at this point. The management is proceeding with construction of the 20-stamp addition to the 60-stamp mill.——Dewatering the Sultana is making progress and normal mining is to be resumed soon. ——The Bullion Exploration Co. is assembling equipment for dewatering the Bullion group. The shaft is 1500 ft. deep and it is understood three electric pumps will be installed. ——The Kenosha mine is being cleared of water at the rate of 15 ft. per day by the Alcalde Gold Mines Co. Lloyd Root, superintendent, is arranging for early mining.——From the 200-ft. level of the Signal Peak a cross-cut is progressing toward an orebody that shows good ore near surface. E. M. Taylor is manager.

Nevada City.—The Illinois placer claim near Logan canyon, Relief Hill district, has been purchased from J. N. Neuman by A. Warrilow of Richmond. Work is to start shortly.——The California Mining Co. is erecting a 15-stamp mill at its gravel property in Willow Valley. The face of the tunnel is within 180 ft. of the Blue Lead channel. The gravel is cemented, requiring crushing for release of the gold.

San Francisco.—On September 8 the U. S. Circuit Court of Appeals dismissed an appeal of the Butte & Superior Mining Co. v. Minerals Separation. The appeal was against certain provisions of the decision of Judge George M. Bourquin at Butte in September 1917.

MICHIGAN

Houghton.—The Mayflower shaft is down 1459 ft., and has intersected stringers of ore for the past 60 ft. At the bottom the shaft is in ore that has the characterictics of the Mayflower lode, although the management is not yet prepared to say so officially. At 1403 ft. the shaft went from the trap into the amygdaloid. The dip of the vein is so flat that exploration by continuing the shaft-sinking is uncertain. There is a great deal of interest in the exploration work being conducted at this shaft, partly because of the assays of the drill cores, and partly because the formation upon which the work is being done is out of the known ore horizon. If this Mayflower-Old Colony work should result successfully it offers opportunity for extensive exploration in many other properties in directions hitherto considered unpromising.

NEVADA

Ely.—The strike, which threatened to develop into a long drawn out struggle with no apparent benefit to anyone, was settled on August 29, and the men in the employ of the Nevada Northern railroad and the Nevada Consolidated Mining company, returned to work on August 30. Of the settlement of the controversy, in which he took such an active part, Governor Boyle said: "I believe there will be no more labor troubles in Ely district for some time to come. The agreement and contract which was signed last night by General Manager Lakenan, representing the company, and which the workmen's committee assures me will be ratified by the men, will result in conditions in the district being bettered and in harmony between the company and its employees. The men lost decisively all along the line in their demands for additional wage increases but won on improved working conditions and the guarantee of the company to establish and maintain an elaborate commissary. The men consider this is of more value to them than the wage increase demanded. I have been assured by the committee that all crafts will resume work tomorrow morning. The strike was

unique because of the completeness of the tie-up, its orderliness, and particularly because of the very apparent good feeling existing on both sides as work resumes. There was not one act of violence during the entire month of the strike, and not one of the men was arrested. There were no locks on the gates and men were boarding at the company's boarding-house and co-operating with the company in the protection of its property.

Austin.—Ore returning good assays in gold, silver, lead, and copper has been discovered three miles from the New Pass mine, 25 miles west of Austin. Numerous locations have been filed and work started at several points. The principal group is owned by Frank McLaughlin of Austin and Warren Dunston of New Pass.——A four-foot vein of $75 silver ore has been uncovered in the old incline of the North Star, at Amador canyon, seven miles north of Austin. Dewatering the incline was completed recently after the property had lain idle 30 years. The main adit is being driven ahead to reach the vein. The North Star is controlled by Charles Kearns and W. B. Cummings of Austin.

Goldfield.—Hoisting ore from the Red Top mine through the Laguna shaft has been started by the Goldfield Development Co. The product is stored in bins of 5000 tons capacity at the Consolidated mill. Repairs to the mill have been practically completed. F. Dean Bradley, mill superintendent, states little change will be made in the flow-sheet until capacity of the 1200-ton plant has been increased to 2000 tons.——Sinking the main winze has been completed at the Crackerjack and a station is being cut. A cross-cut will be driven from this point to reach the Crackerjack vein at a vertical depth of 440 ft. and is calculated to reach the vein in two weeks. On the 340-ft. level the vein is 18 ft. wide with 8 ft. assaying $25 per ton in gold and silver.

Sunshine.—The J. B. Ratliff lease on the Gem Five mine has exposed an ore-shoot showing native silver, hornsilver, and chlorides. Some gold also occurs. Sinking a 100-ft. shaft is proceeding.

UTAH

Tintic.—Ore shipments from the Tintic district for the month of August show a large increase over shipments for the month of July. In the shipments are included one car of bullion from the Tintic mill valued at $90,000, while the ore shipped is estimated to be worth in the neighborhood of half a million. The output follows:

	Cars
Alaska (lease)	4
Centennial Eureka	33
Chief Consolidated	136
Bullion Beck	4
Colorado Consolidated	39
Dragon Consolidated	94
Iron Blossom	77
Eureka Mines	1
Eagle and Blue Bell	50
Empire Mines	2
Grand Central	23
Gemini	20
Mammoth	41
Ridge & Valley	9
Showers	1
Sunbeam	2
Swansea	16
Tesora	5
Tintic Standard	79
Victoria	8
Utah Consolidated	1
Tintic mill (bullion)	1
Total	646

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

Harold Rickard is at Toronto.

T. A. Rickard is at Kellogg, Idaho.

Albert Burch has returned from Butte to San Francisco.

F. W. Bradley, who has been in the interior of Alaska, is now at Treadwell.

J. Dawson Hawkins, of Colorado Springs, was in San Francisco last week.

John A. Agnew has been elected president of the Mining and Metallurgical Club, in London.

S. R. Wagel, of New York, and **C. A. Heberlein** are on their way to Spokane and the Coeur d'Alene.

Arthur L. Pearse has returned to New York from an inspection of the Kirkland Lake district in Northern Ontario.

Arthur J. Hoskin has moved his office to 401 Kittredge Bdg., Denver. He has returned thither from Grand Valley, Colorado.

Thomas T. Read is Engineer in Charge of the Division of Education and Information in the U. S. Bureau of Mines, at Washington.

A. W. Stevens, superintendent and manager for the Idaho Consolidated Mining Co., at Atlanta, Idaho, will re-open the old Boise-King placer mine.

Arthur H. P. Moline has been promoted from superintendent to general manager of the Bendigo Amalgamated group of mines, at Bendigo, Victoria.

Herbert C. Hoover sailed from Liverpool on September 6. On his arrival at New York he will be given a complimentary dinner by the engineering profession.

E. W. Wagy, petroleum engineer of the U. S. Bureau of Mines, has transferred his headquarters from the San Francisco office of the Bureau to the office at Washington.

Shigemi Ohta and **Ritaro Hirota** were in San Francisco last week and have gone East to inspect mining machinery with which to combat the increased cost of labor in Japan.

C. E. Carstens, Lieutenant in the Chemical Warfare Service, has received his discharge and resumed his position in the Research Department of the Anaconda Copper Mining Co., at Anaconda, Montana.

O. J. Egleston, chief engineer for the United States Smelting, Refining & Mining Co. in its Western field, is to succeed George W. Metcalfe as general manager for the Mammoth Copper Co. at Kennett, California.

George W. Metcalfe, general manager of the mines and smelter of the Mammoth Copper Co., is to leave Kennett to take up other work for the parent corporation, the United States Smelting, Refining & Mining Company.

Forrest B. Smith, who is traveling in the interests of the American Mining Congress, is in San Francisco for ten days or two weeks. He may be addressed in care of the California Metal Producers Association, Merchants Trust building.

Gilbert Rigg, assistant to the managing director of the Broken Hill Associated Smelters, and consulting engineer to the Electrolytic Zinc Company of Australasia, passed through San Francisco on August 29 on his way to New York and London.

Van H. Manning, Director of the U. S. Bureau of Mines, accompanied by **Mr. Bailey,** assistant director, **Dr. E. W. Dean,** in charge of the petroleum work at the Pittsburgh station, and **Dr. Kendle,** of the Mine Rescue Division, spent several days during the month of August visiting the San Francisco and Berkeley stations of the Bureau of Mines.

THE METAL MARKET

METAL PRICES

San Francisco, September 10

Aluminum dust, cents per pound	50—60
Antimony, cents per pound	10.00
Copper, electrolytic, cents per pound	23.50—24.00
Lead, pig, cents per pound	6.25—7.25
Platinum, pure, per ounce	$105
Platinum, 10% iridium, per ounce	$111
Quicksilver, per flask of 75 lb	$103
Spelter, cents per pound	9.50
Zinc dust, cents per pound	11.00—13.50

EASTERN METAL MARKET

(By wire from New York)

Sept. 9.—Copper is quiet and steady. Lead is inactive but easy. Zinc is dull and lower.

SILVER

Below are given official or ticker quotations in cents per ounce of silver 999 fine. From April 23, 1918, the United States government paid $1 per ounce for all silver purchased by it, fixing a maximum of $1.01½ on August 15, 1918, and will continue to pay $1 until the quantity specified under the Act is purchased, probably extending over several years. On May 5, 1919, all restrictions on the metal were removed, resulting in fluctuations. During the restricted period, the British government fixed the maximum price five times, the last being on March 25, 1919, on account of the low rate of sterling exchange, but removed all restrictions on May 10. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the normal rate of exchange.

Date	New York cents	London pence		Average week ending	New York cents	London pence
Sept. 3	108.50	61.00	July	29	106.54	54.99
4	113.50	61.00	Aug.	5	108.08	55.17
5	113.12	61.00	"	12	110.58	58.02
6	112.62	60.75	"	19	112.68	59.14
7	Sunday		"	26	112.00	60.66
8	111.75	61.00	Sept.	2	111.45	58.93
9	112.50	61.00	"	9	111.99	60.96

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	75.14	88.72	101.12	July	78.92	99.62	106.36
Feb.	77.54	85.79	101.12	Aug.	85.40	100.31	111.35
Mch.	74.13	88.11	101.12	Sept.	100.73	101.12	....
Apr.	72.51	95.35	101.12	Oct.	87.38	101.12	....
May	74.61	99.50	107.23	Nov.	85.97	101.12	....
June	76.44	99.50	110.50	Dec.	85.97	101.12	....

COPPER

Prices of electrolytic in New York, in cents per pound

Date		Average week ending		
Sept. 3	22.50	July	29	23.50
4	22.25	Aug.	5	22.87
5	22.25		12	22.20
6	22.25		19	22.33
7	Sunday		26	22.83
8	22.50	Sept.	2	22.55
9	22.50		9	22.37

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	29.53	23.50	20.43	July	29.67	26.00	20.82
Feb.	34.57	23.50	17.34	Aug.	27.42	26.00	22.51
Mch.	36.00	23.50	15.05	Sept.	25.11	26.00	....
Apr.	33.16	23.50	15.23	Oct.	23.50	26.00	....
May	31.69	23.50	15.91	Nov.	23.50	26.00	....
June	32.57	23.50	17.53	Dec.	23.50	26.00	....

LEAD

Lead is quoted in cents per pound, New York delivery

Date		Average week ending		
Sept. 3	5.90	July	29	5.91
4	5.85	Aug.	5	5.87
5	5.80		12	5.84
6	5.75		19	5.88
7	Sunday		26	5.88
8	5.85	Sept.	2	5.90
9	5.85		9	5.83

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	7.64	6.85	5.60	July	10.93	8.03	5.53
Feb.	9.10	7.07	5.13	Aug.	10.75	8.05	5.78
Mch.	10.07	7.28	5.24	Sept.	9.07	8.05	....
Apr.	9.38	6.99	5.05	Oct.	6.97	8.05	....
May	10.29	6.88	5.04	Nov.	6.38	8.05	....
June	11.74	7.59	5.32	Dec.	6.40	6.90	....

TIN

Prices in New York, in cents per pound:

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	44.10	85.13	71.50	July	62.60	93.00	70.11
Feb.	51.47	85.00	72.44	Aug.	62.53	91.33	62.20
Mch.	54.27	85.00	72.50	Sept.	61.54	80.40	....
Apr.	55.63	88.53	72.50	Oct.	62.24	78.82	....
May	63.21	100.01	72.50	Nov.	74.18	73.67	....
June	61.93	91.00	71.83	Dec.	85.00	71.52	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound

Date		Average week ending		
Sept. 3	7.85	July	29	8.32
4	7.80	Aug.	5	7.64
5	7.75		12	7.64
6	7.72		19	7.86
7	Sunday		26	8.00
8	7.72	Sept.	2	7.89
9	7.72		9	7.76

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	9.75	7.78	7.44	July	8.98	8.72	7.78
Feb.	10.45	7.97	6.71	Aug.	8.58	8.78	7.81
Mch.	10.78	7.67	6.53	Sept.	8.33	9.58	.
Apr.	10.20	7.04	6.49	Oct.	8.32	9.11	....
May	9.41	7.92	6.43	Nov.	7.76	8.75	....
June	9.63	7.92	6.91	Dec.	7.84	8.49	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. Prices, in dollars per flask of 75 pounds:

Date			
Aug. 12	105.00	Aug. 26	100.00
" 19	105.00	Sept. 2	95.00
		" 10	103.00

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	81.00	128.06	103.75	July	102.00	120.00	100.00
Feb.	126.25	118.00	90.00	Aug.	115.00	120.00	103.00
Mch.	113.75	112.00	72.80	Sept.	112.00	120.00	....
Apr.	114.50	115.00	73.12	Oct.	102.00	120.00	....
May	104.00	110.00	84.80	Nov.	102.50	120.00	....
June	85.50	112.00	94.40	Dec.	117.42	115.00	....

FOREIGN EXCHANGE

Foreign exchange declined again during the week. This decline was started the preceding week by the action of the Bank of England in reducing the rate of interest on foreign balances from 4½% to 3%. It is possible the joint-stock banks now may follow suit. Apparently the new departure is in keeping with the indifference displayed by the British authorities as to what becomes of sterling in New York and other foreign centres. The theory is advanced that the action of the Bank of England is prompted with a view to driving foreign money, now in London, into British investments. With a loss facing them of perhaps more than 10% on sterling if their balances are transferred back to this side, American bankers and others may elect, when they observe this reduction in interest rates, to invest in British war bonds or other English securities selling at attractive yields. Sterling around $4 is regarded as the ultimate salvation of British security values. Therefore, England is not worrying over the raising of credits here now. It means more to her if things are allowed to mend naturally. The Bank of England has been paying interest on foreign balances only through joint-stock banks. It carries no such balances directly, but it has allowed joint-stock banks 4½% on this class of deposits carried with them, on which they have in turn allowed their foreign correspondent ¼% less.

In drawing on her financial resources during the War England left the great mass of her home securities impaired in quoted values. The British people, rich as they were collectively, could not carry a $40,000,000,000 war burden without sacrifices in other directions. British investors were denied benefit of a war boom, such as American investors experienced, while financing, on their part, a $30,000,000,000 war. To crown all, a short-sighted if not embarrassed government failed to make proper provision for protecting the finances of British railroads when taken over. As a consequence, practically the whole list of gilt-edged British securities have never recovered from the first crash that followed outbreak of the War. They are lower now than they were then. The British investment market is so thoroughly saturated with government war issues that it seemed well nigh hopeless to look for any restoration of former security values for a long time. Private investors, trustees, and fiduciary institutions have viewed the situation with dismay.

Meanwhile the provision of foreign credits on a broad scale seems no nearer so far as tangible developments are concerned. Such small credits as are advanced to particular countries for specific purposes are in fact regarded as tending only to defer such a general settlement. Not many weeks ago the problem of foreign trade, the establishment of credits, and the promotion of reconstruction work in Europe were the chief topics of concern and discussion in financial circles. But domestic problems, chiefly concerning relations between capital and labor, and bordering on a crisis, forced all other considerations into the background. A practical truce has, however, been declared for a time by the labor forces pending efforts to bring down the cost of living, and with domestic affairs on the way to some solution it may be expected that the problems relating to foreign exchange and the financing of foreign countries may be worked out in the next two or three months. The possibility of restoring foreign exchanges and working out a method of extending billions of credit to Europe contains the greatest possibilities for American business.

Quotations on September 10 are as follows:

Sterling	Cable	4.16½
	Demand	4.15½
Francs	Cable	8.35
	Demand	8.37
Lire	Demand	9.65
Marks		1.25

Eastern Metal Market

New York, September 3.

Because of the holiday on Monday, and practically one on Saturday, all the markets were quiet the past week, and so far this week they have not recovered much momentum.

Copper demand has been light and the market controlled largely by second hands and dealers.

The tin market has been quiet and very little business has been done.

Demand for lead has not been heavy, but prices continue steady.

The zinc market has eased off slightly and demand is very light and quotations nominal.

Antimony shows little change.

IRON AND STEEL

Pig-iron production on September 1, according to the blast-furnace reports of 'The Iron Age', was 93,360 tons per day, or at a yearly rate of about 34,500,000 tons. The daily rate a month ago was 85,635 tons. The August output was 2,743,388 gross tons as compared with 2,428,541 tons in July. The blowing in of furnaces continued in August, 266 being in blast on September 1 as against 239 on August 1, a net gain of 27. The tendency toward higher pig-iron prices is pronounced, especially in the Cleveland and eastern Pennsylvania districts where advances of 50c. to $1 have been made. With labor difficulties temporarily out of the way the iron and steel trade is beginning to devote itself to the commercial developments that are probable in the near future. Steel output in August will probably equal that of July.

COPPER

The demand that has appeared in the last week has been light and has been almost entirely satisfied by the outside market. Quotations are firm at 22.75c., New York, for electrolytic copper for September delivery from dealers and second hands, but it is believed that the amount obtainable is not large. Producers still continue firm in their quotations of 23.50c., New York, for electrolytic copper for September delivery with October held at 24c. Lake copper is quoted at 23.50c., New York, in the outside market with some producers holding to 24c., New York, both for September delivery. Most large consumers are believed to be well provided for September consumption.

TIN

The market has been extremely quiet the past week and very little business has been done. Spot Straits, New York, after easing off to 55.50c. last Wednesday, is again quoted at 56c., New York. Buyers have been uneasy the last week because of the possibility of strikes. Today, however, the situation is much better and the outlook more encouraging as to strikes, and sentiment on the entire non-ferrous market is stronger. A little business was done the middle of last week at 52.50c. in Straits tin due in September, and at 53.25c. on the same due early in September. Offerings of Straits tin for September shipment from the East have been made at 53c. Tin arrivals continue heavy, having been 5215 tons to August 26 inclusive, of which 2075 tons came in at Pacific ports. There was 3590 tons afloat. An interesting statement is that of George Armsby to the effect that a rebate of 2.98c. per lb. is given to all those who absorbed the allocated tin at 72.50c., thus making their net cost 69.52c. per lb. A statement is made public that all Ordnance surplus tin will not be sold but will be used by the ammunition division for future manufacturing purposes.

LEAD

This market has also been quiet the past week in line with all the rest. Odd lots have been offered at New York as low as 5.85c. and so New York has continued to be the weak point in the market. Some producers have sold lead at Middle Western points at an equivalent of 6.10c., New York. We quote the market in view of these facts at 5.90c., New York, or 5.65c., St. Louis. The American Smelting & Refining Co. continues to maintain a quotation of 6c., New York, or 5.75c., St. Louis, for early delivery. The labor situation has also affected this market.

ZINC

Because of the light demand and the possibility of a steel strike, prices have declined and the market has been quiet and easy. Prime Western for early delivery is obtainable at 7.50c., St. Louis, or 7.85c., New York, which we quote as the nominal market. A disturbing factor in this market has been the fact that German zinc has been selling in foreign markets as low as 5c. per lb., based on comparative grades here. Liberal sales are reported to have been made in Norway, Sweden, France, and perhaps England. The prospect of less strike trouble is today the cause of a firmer tone to the market.

ANTIMONY

Asiatic grades are quoted at 9.25 to 9.50c., New York, duty paid, for wholesale lots for early delivery. The market is strong.

ALUMINUM

Quotations for virgin metal, 98 to 99% pure, are unchanged at 32 to 33c., New York, for early delivery.

ORES

Tungsten: Pending some decision as to a tariff on tungsten ores the market has been very quiet. Buyers and sellers hesitate as to their future course. Quotations on Chinese ore are $7.50 per unit with Bolivian ore at $10 per unit, duty if any for buyers' account. Quotations on ferrotungsten are uncertain, more so than ever. British ferrotungsten, 75 to 80%, was quoted in August at 3s. per lb. of contained tungsten with the metal powder, 96 to 98%, at 3s.6d. per pound.

Molybdenum: The market is unchanged and still dull with quotations nominal at 75c. per lb. of MoS_2 in regular concentrates.

Manganese-Iron Alloys: British producers are taking business now at $95, seaboard, but whether this is their established quotation it is difficult to say. Some will not take any more orders at $95. It is evident that the British manufacturers are making a drive for this market. Already some American producers have taken steps to prevent any more British alloy coming into the country on the basis that it is in violation of the anti-dumping law, as it is asserted that the British producers cannot make the alloy and deliver it at present prices except at a loss. The market is active with inquiries of from 5000 to 7000 tons for delivery in the last quarter and first quarter or the next six months. London sales of British alloy have been made at $95, seaboard. Spiegeleisen is quiet and nominal at $35, furnace.

Pig iron production for the first half of 1919 is 16,278,175 tons, against 20,826,914 tons for the last half of 1918, and 18,227,730 tons for the first half of 1918. Of this year's product, 11,779,042 went to consuming interests and 4,499,133 was sold.

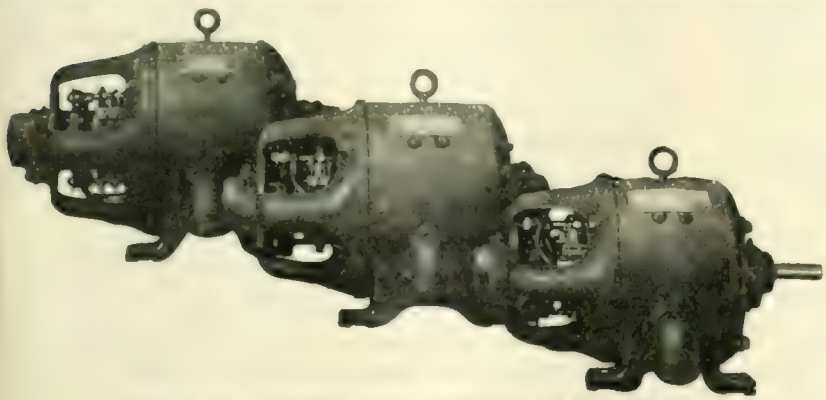
INDUSTRIAL PROGRESS

INFORMATION FURNISHED BY MANUFACTURERS

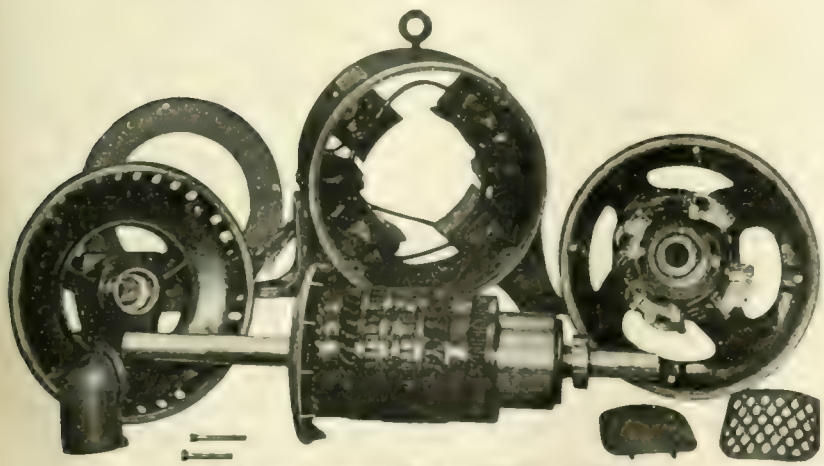
NEW DESIGN OF ALLIS-CHALMERS MOTORS AND GENERATORS

A new line of commutating-pole direct-current motors and generators, known as type E, has been introduced by the Allis-Chalmers Manufacturing Co. The machines are rugged and compact, with excellent operating characteristics, and the many details which contribute to accessibility, reliability, and safety have been thoroughly worked out.

These new type E machines incorporate the latest and best features of direct current engineering practice in the design, construction, and commercial application of motors and generators for practically every industry. They have been designed for belted as well as direct connected application, and are particularly suited to the exacting requirements of machine tool service. Among their important features are the following: (1) Ratings and speeds corresponding to standard 60 cycle induction motors. (2) A complete line of constant and adjustable speed ratings. (3) Rugged cast steel yokes. (4) Commutating poles, insuring sparkless commutation. (5) Dust-proof bearings. (6) Windings treated to resist oil and moisture. (7) Thorough ventilation. (8) Conduit terminal boxes on all motors. (9) Improved box type brush holders. (10)Standard enclosing covers. (11) Interchangeable parts. (12) All parts easily accessible.



Group of Type E Motors, 20 hp., 10 hp., and 5 hp., 1150 r.p.m.



Type E Motor Dismantled, 25 hp., 230 Volt, 1150 r.p.m.

In developing this line it has been the aim of the Allis-Chalmers company to produce not only a rugged serviceable motor, with the best operating characteristics, but also to incorporate the many details which contribute to reliability and safety. The following standard ratings are included.

1. Continuous rated (50°C. rise) motors, for applications where the power requirements are definitely known.
2. Normal rated (40°C. rise) general purpose motors.
3. Adjustable-speed motors for continuous or intermittent service.
4. Generators and exciters.

For constant-speed motors the ratings and speeds are the same as those of 60-cycle induction motors, and they can thus be used interchangeably with induction motors for direct connected applications without changing the method of drive or the ratio of gearing. Adjustable speed motors, intended particularly for machine tool and similar applications, are provided for 2:1, 3:1, or 4:1 speed range. Generator speeds also correspond to those of induction motors, thus permitting the direct coupling of the machines to form motor-generator sets in various combinations. The line of ratings now complete covers motors from ½ to 50 hp. and generators from ½ to 40 kw., and larger sizes are under development. Cast-steel yokes, combining light weight and rigid construction, are used for the larger ratings, whereas the smaller machines, which are of the bi-polar type, have riveted frames.

Semi-Enclosed Type E Motor

The accessibility of the commutator is apparent from the illustrations. Protecting grid covers can be provided for the openings in the front bearing bracket; they are readily attached and may be applied even to machines in service, without affecting the rating. Solid covers are used with completely enclosed motors, the rating of these machines being somewhat lower than open or semi-enclosed motors.

All machines have ring oiling dust-proof bearings, and the windings are treated to resist oil and moisture. Conduit terminal boxes, regularly supplied, have removable covers, giving ready access to the terminals. Box-type brush holders are adjustable for tension and suitable for either direction of rotation. Each holder can be removed independently with a screw-driver or wrench. At least two brushes per stud are used.

The field coils are wound on metal spools, which prevent any movement of the coils, and are protected by an outside layer of enameled wire. The armature core has the laminations riveted together, permitting the removal of the shaft without dismantling the core or commutator, and for ratings of 20 hp., 850 r.p.m., and larger, the core and commutator are built on a sleeve, so that the shaft can be pressed out of the finished armature without disturbing the windings.

An important feature is the thorough ventilating system which has been provided. The air is drawn out by a fan mounted on the rear armature head, fresh cool air flowing in through the ventilating ducts and taking the heat from the iron and windings. This heated air is forced out through openings in the periphery of the rear bearing-bracket. With thorough ventilation the internal temperatures are kept low thus greatly prolonging the life of the insulation. The entire line is new throughout, no attempt having been made to re-design old apparatus or to employ parts from any previous machines. Bulletin No. 1106, describing these motors and generators in more detail, has just been issued.

WESTINGHOUSE ELECTRICAL APPARATUS AT GEORGIA SCHOOL OF TECHNOLOGY

By M. Emmilinne Pitt

The Georgia School of Technology is having installed a full equipment of Westinghouse electrical apparatus. This is a practically complete electrical equipment for a small power plant, consisting of the following apparatus:

One 187 kva., 3 phase, 60 cycle, 220 volt, A.C. generator driven by a 150-kw. turbine through induction gear. Also a 125 kva. 80% power factor unit of similar characteristics. For condensing the steam from these two turbines there will be supplied one surface condenser. There will also be supplied one 175 kva. coupled type generator suitable for gas or steam engine drive. For excitation of the above A.C. generators there will be provided one 25 kw. D.C. geared turbine exciter unit. For miscellaneous service there will be supplied one motor-generator set consisting of a 3-phase induction motor driving a 50 kw. D.C. generator. Driving power to auxiliaries and experimental work will be furnished by one 15 hp., two 50 hp., and one 100 hp. squirrel cage induction motors; these motors are all complete with reels, pulleys, and suitable auto starters of modern design. Three 50 kva. single phase, 60 cycle distribution type transformers, 220 volts low tension, 2200 volts high tension, and one 2 kva. 50,000 volts self-contained testing outfit are also included, together with a complete switchboard with an automatic voltage regulator and necessary control for all of the above generators and exciters. This equipment is modern and altogether is an excellent exhibit of a modern power plant and distribution system on a small scale.

HOME BUILDING PROGRAM

Due to the difficulty the employees of the Westinghouse Electric & Manufacturing Co. have experienced in getting homes near the East Pittsburgh works, the company has resumed the home building program that was postponed during the War. Forty-eight houses are now under construction. The site for the new dwellings is on a plot of 109 acres owned by the company in Wilkins township along Ardmore boulevard. The new houses will form a part of the general building plan for developing the entire tract. It is estimated this tract will furnish homes for six hundred families. Side-walks and paving will be laid, and gas, water, and electricity will be installed. The houses, which are modern in construction, will be of brick with hollow tile backing, with concrete cellars and cement porches. They will consist mainly of five, six, and seven rooms designed to meet the needs and the pocketbook of the man in moderate circumstances and will be sold at cost on easy terms to the employees of the company. A number of the dwellings will be for rent.

In building the new homes an effort has been made to do away with features that have outlived their usefulness. The antiquated parlor is missing and the centre hall has been replaced with a modern living room which is more economical of space. Those in charge of the building program have made a careful study of the war-time houses erected by the Housing Commission, especially those built in the Philadelphia district for the use of the employees of the Essington works.

The Westinghouse company is one of the pioneers in building homes for its employees, having constructed 72 homes near the Trafford foundry almost ten years ago, as well as owning 127 apartments and homes in Trafford proper. It is likely the building scheme at present under way will later include apartments and duplex houses. T. P. Gaylord, vice-president of the Westinghouse company, is in charge of the building program. Bernard H. Prack, the architect and builder, expects to have the first of the houses ready for occupancy by October 1.

COMMERCIAL PARAGRAPHS

Allis-Chalmers Manufacturing Co. has just issued Bulletin No. 1812 on crushing rolls. This is an eight-page pamphlet describing rolls for spring pressure up to 2000 lb. per inch of roll face, designed for use in small mills and sampling plants where the conditions are such that a heavy roll is not required.

The Chicago Pneumatic Tool Co. announces the removal of their Cincinnati office from the Mercantile Library Bdg. to the Walsh Bdg., Pearl and Vine St., where a service station with a complete stock of pneumatic tools, electric tools, air compressors, oil engines, rock drills, and repair parts will be maintained.

The Wellman-Seaver-Morgan Co. has issued Bulletin No. 27, describing automatic ore unloaders in use on the Great Lakes. This bulletin, which is an 8½ by 11 in. pamphlet of 12 pages, contains numerous excellent illustrations of ore unloaders in action, accompanied by clear and interesting description of their capacities and operation. It will be sent free on request.

The Engineering & Sales Corp. of Chicago has just opened a branch office in San Francisco in the Rialto Bdg. to cover the Pacific Coast in various lines that it handles. It will also maintain an engineering office for the purpose of handling the design, consultation, supervision, etc., on automobiles, trucks, and tractors. The engineering department is under the supervision of F. H. Meyer. S. C. Kyle is the Pacific Coast manager.

The King Trailer Co. has recently opened its own factory branch in Dallas, Texas. This is at 1818 Main street, in the automobile district, and is in charge of A. G. Williams, South-Western sales manager. This step was taken in order to make quick delivery and give prompt service in the State of Texas, and particularly in the oilfield district, where hundreds of King trailers are already in use. A full stock of trailers and repair parts will be carried at the Dallas branch and every effort will be made to give the best of service.

SOMEBODY recently defined an optimist as a man who still carries a bottle-opener attached to his key-ring.

THE strike of the miners and railway men at Ely, Nevada, which was settled on August 29 so satisfactorily to all concerned, was one of the most remarkable that we remember in the lack of violence and in evident good-feeling on both sides. The men continued to board at the company's boarding-house and co-operated with the company in the protection of its property.

CAPTAIN ANDRE TARDIEU, speaking on September 2 before the Chamber of Deputies in Paris during a debate on the ratification of the German Peace Treaty, said the French War losses were 26% of the men mobilized. Of all men under 31 years old with the colors, 57% were killed. This last figure, particularly, is appalling. We on this side of the Atlantic find such losses difficult to grasp; we are too far away to realize fully the plight of that unhappy country. In the light of such statistics, it is small wonder that France demands assurance against a third invasion by her hereditary foe on the east.

A TELEGRAM from Dawson stated that mining had ceased on Bonanza and Eldorado creeks, the two dredges of the Yukon Gold Company having stopped operations, preparatory to being dismantled and shipped to Seattle. This is not quite correct. These two dredges, the only steel dredges introduced into this district, worked for three or four years and were dismantled in 1917. It is said that they will be sent to Burma or to the Malay States to win tin from the alluvial deposits in those regions. We know that Mr. C. H. Munro and other engineers are in that part of the world seeking suitable opportunities for profitable dredging, so the statement appears reasonable. The Yukon Gold Company is still dredging on Hunker, Gold Run, and Bear creeks, and in the bed of the main stream, the Klondike. The valleys of the Upper Yukon have yielded 200 million dollars worth of gold since 1898.

ANOTHER decision in favor of Minerals Separation, although not on the technology of the flotation process, was recorded on September 8 when the U. S. Circuit Court of Appeals in San Francisco dismissed an appeal of the Butte & Superior Mining Company against Minerals Separation. This appeal covered the payment of costs assessed against the Butte & Superior company in the mandate of the Supreme Court of the United States, directed to the United States District Court of Montana. Butte & Superior took the position that as suit was begun in 1913, and the disclaimer was not filed in the Patent Office until 1917, it should not be liable for the costs. The decision in San Francisco held that Butte & Superior should look to the Supreme Court of the United States for its remedy, and accordingly dismissed the appeal. A petition has been prepared by Butte & Superior, which will be filed in the Supreme Court, asking the court to recall the mandate and disallow the costs.

THE American Institute of Mining and Metallurgical Engineers will hold its fall meeting in Chicago from September 22 to 26. Convention headquarters, where most of the meetings and technical sessions will be held, is to be at the Congress Hotel. More than 150 technical papers have been prepared, so the meeting should be richly supplied with material for the interchange of experiences in recent technology, and to serve as a basis for profitable discussion. There is, however, another side to a meeting of this kind that is not less important, namely, the sociable mingling of men of sympathetic interests, many of them from mining districts on the outskirts of civilization and correspondingly far from congenial companionship and the stimulation of unfamiliar minds. We are glad to see that this most necessary feature has received the enthusiastic attention of the committee, and has been carefully planned. The wives and daughters of members are cordially invited, and many excursions have been contrived for the entertainment of these ex-officio members of the Institute. It is promised that the smoker will be most unusual. Rumor has it—although we cannot vouch for the truth of this—that at the smoker the more serious purposes of the meeting are to be lightened by the presentation of a comedy by a member with an infectious sense of humor and a happy faculty for expression. The title bears a resemblance to a famous metallurgical process whose patents have added to the income taxes of an army of lawyers for many years; the characters have been taken from life; the names are easily recognizable. The banquet is to be held in the middle of the week, so that members who can come for only part of the meeting will almost certainly be able to be present at the banquet. This seems a wise provision, in accord with a suitable attention to the social side. The speakers will include

Mr. Horace V. Winchell, president of the Institute, General Leonard Wood, and Mr. Charles M. Schwab. Captain Robert W. Hunt will be toastmaster. We wish the meeting every success.

DISCUSSION this week opens with a letter from Mr. Charles A. Porter, who writes entertainingly and informingly on 'The Miner and the Protective Tariff'. Under the present law the miner pays an artificially high price for the tools he uses, whereas the metals that he produces are either on the free list or else protected by a tariff disproportionately low. Mr. Philip Argall sends us an interesting letter in defence of Dr. Keith's attack on the patents of the Crowe process, and in support of his opinion gives a detailed description of an apparatus for de-gassing cyanide solutions that was in use and open to inspection 11 years ago. Mr. J. H. Marion, in reply to Professor Uren's article on 'Conventional Symbols for Mine-Maps', submits an alternative set of symbols that he has used with success. Mr. A. R. Pierce writes on the subject of 'Sampling Large Low-Grade Orebodies', which was discussed freely in our columns a few months ago. It will be observed that Mr. Pierce is in error on one point; he assumes that the method of determining a sampling factor by comparing hand-samples with mill-tests, as advocated by Mr. Webber, was intended to be applied only to deposits for which the sampling-factor would be uniform over large areas, whereas those who have followed this discussion from the beginning will remember that it had its inception in the difficulty of sampling with accuracy deposits whose metal occurrence was essentially erratic. Mr. Pierce believes the 'combination method' would be most valuable for low-grade deposits in which the gold is uniformly distributed, but would like enlightenment on some of the details to be observed in taking the bulk-samples.

MEXICO has again come to the fore with a proposal a little more impudent than any that we recall from that land of impudent proposals and insolent threats, but this time it is from the revolutionists instead of the Carranza government. An appeal has been presented at Washington for formal recognition by the United States of the belligerency of the various anti-Carranza factions, and for financial aid toward the overthrow of Carranza and the assembly of a provisional coalition government. This appeal bears the signatures of Gilarado Magara, commander of the 'reorganizing army'; Guillermo Meixuelro, commander of the 'defensive forces of the free and sovereign State of Oaxaca'; Felipe Angeles and Francisco Villa, commanders of the 'convention forces'; and Manuel Pelaez, commander of the 'Constitution of 1857 revolutionary army'. A conference is proposed with representatives of the United States in order to formulate a program for "reconstruction and restoration" of Mexico. By all means! Having failed in our policy of 'watchful waiting', having seen our recognition of Carranza earn only the contempt and silly threats of that suave gentleman, let us now ally ourselves with the bandits that raided Columbus, that robbed the seamen from the U. S. S. 'Cheyenne', that recently held two of our uniformed aviators for ransom, and more recently seriously wounded the pilot of an army aeroplane that ventured too near the border, and that have committed outrages without end, growing bolder and more insolent year by year as their contempt for us increased. Truly American forbearance is much misunderstood by our troubled neighbor on the south!

SHALL policemen and firemen organize? Or, at least, shall they enforce by strikes demands made collectively? The recent riots at Boston must have brought this issue home to every thinking American. From the unionization of policemen and firemen is but a step to the unionization of the Army and Navy. Indeed, this contingency is even now being discussed. Collective bargaining, that principle by which men with a common interest band themselves together in order that their spokesmen may present their demands with the full backing of their organization, has undoubtedly come to stay. We do not think that many men would have it otherwise. But collective bargaining of the kind that urges men, sworn to uphold law and order, to leave their posts and abandon the institutions in their care to mob violence, is a different matter. Two thousand years ago the plight of him who would serve two masters was foretold. The rapidity with which the situation at Boston got out of hand, so that Governor Coolidge was forced to take command and telegraph the Federal government to be in readiness to aid him with the army and navy, is a warning of what may be expected to take place in many of our large cities if this vicious tendency is not checked at the start. A simultaneous strike of policemen and firemen, combined with the activities of a few incendiaries, would produce a result easily and horribly pictured by anyone who remembers the fires of Chicago and San Francisco. This matter hits the very roots of government; the issue is quite different from that in ordinary industrial disputes. The proper method to obtain reform in the administration of the government of a democracy is by the ballot. An attempt by an organized minority that for some reason holds a position of power to bring about by force changes in methods of government, or changes in the administration of affairs under government control, is as intolerable as the domination of an aggressive autocracy such as that the world has fought for five years. Both are directly opposed to that great principle of democracy, government with the consent of the governed; both attempt to substitute the rule of the bullet for that of the ballot. The policeman is in a position of peculiar responsibility. Like the men in the army and navy, he is one of the ties that hold our government together, and that enforce the will of the majority, peacefully determined, upon that small lawless element that lurks in every community. Upon these rests a responsibility that the ordinary industrial worker entirely lacks. The people should consider carefully what

they would have men in these callings on for at the end of the restless times we are now experiencing only that which has the support of the country as a whole will endure, and the men themselves should take stock of their responsibilities before they abandon the institutions they are sworn to protect, and embark upon a course that, if followed to its logical conclusion, would lay our government by the people, of which we are so proud, at the mercy of any organized minority that could hit us vitally enough to enforce its demands.

Class Journalism—I

The journalism that speaks for the engineering profession has grown with its clientele and with the development, in a world-wide sense, of the industries in which its supporters are engaged. The kind of publication through which it does its work is called sometimes a 'trade' paper, sometimes a 'professional' paper, and it must be confessed that few of the engineering journals merit the loftier and narrower designation; but it is scarcely worth while to discuss the choice of epithets, because another more comprehensive and more accurately descriptive term is available, namely, 'class' journalism. This conveys its basic purpose, which is to interest and to inform, and thereby to please, a particular class in the community, so as to render the journal itself an effective medium of publicity for those who sell the materials needed by that class. An engineering paper, for example, makes its appeal to the engineers that have the selection and the ordering of the machinery and supplies offered for sale by the manufacturers whose advertisements appear in that paper. Most readers of the technical press are aware by this time that their subscriptions do not even pay the mechanical cost of publication—the paper, printing, and postage—and that the publication of their favorite journal would be discontinued tomorrow if it depended solely upon the revenue derived from subscriptions. These represent only a small fraction of the total receipts of a successful publishing business. It is evident therefore that the commercial basis of a class journal is the printing of information that will be read by those whom the advertisers desire to reach, and whom they will reach effectually if the reading matter is such as will cause the subscribers, or others into whose hands the paper falls, to turn over the advertising pages. It is essential that this, the primary purpose of class journalism, should be frankly recognized. Nor does it require the least apology; on the contrary, it serves to establish the independence of the editorial department, in a manner not permitted to papers whose financial support comes directly from their readers. The editor of a class journal has to interest the class to whom he addresses himself; the advertisers, if they are sagacious, as they are, will ask only that he retain the willing attention of those with whom they, as manufacturers, desire to do business. Thus those who furnish the principal financial support of the paper have nothing to say about its opinions, and the subscription price paid by those who care most about its opinions is not essential to its support, provided the paper is read by them. The engineer that reads his class journal without subscribing—as in a library or by sharing another's copy—is a more useful client to the publisher than the engineer that subscribes and does not read the publication. This is a cynical fact insufficiently appreciated by most advertisers. They expect the publisher whom they pay for publicity to put the paper into the hands of possible customers and it should not matter to them whether such customers are subscribers or not; but it should matter to them whether the subscribers are in arrears, because the subscriber that cannot or will not pay the small subscription is unlikely to be able to purchase their products, and if he has the money and fails to pay his subscription he may prove a bad risk in larger transactions. Returning to the relation of the editor and the advertiser, their efforts converge in a desire to interest the same class, but the advertiser can have nothing to say about the reading matter provided it succeeds in arousing that interest, and of this the editor should be the best judge; otherwise he will fail in his duty. The modern Greek word for 'editor' is *suntaktēs*, he that assembles the reading matter. If the advertiser asks the editor to insert some of the advertiser's own writing or a contribution prepared by an agent of his, he is foolish, because the publication of such matter in false guise undermines the confidence of the reader and thereby lessens the effectiveness of the paper as a medium of publicity, because the annoyance or disgust felt at finding a puff or 'write-up' masquerading as a technical or descriptive article will cause the discriminating reader—the very one whom it is the desire of the advertiser to reach— to throw the journal or magazine into the waste-paper basket. Good faith is essential to business; the advertiser and the editor that conspire even tacitly to fool the reader by indirection will forfeit his confidence. In order to hold that confidence thoroughly, not only in preserving a judicious detachment from the advertising, but in showing a thorough knowledge of the ideas and ideals of the class to which the journal makes its appeal, it is desirable that the editor should belong to the class that he addresses. For example, the editors of the two leading mining papers have been recruited, so far, from the mining engineering profession, not from daily or financial journalism. We hope that this tradition will be maintained, because it is in harmony with the basic idea of class journalism, namely, the printing of writings prepared in sympathetic understanding of the point of view and the higher interests of a special class. No journalist, however clever, can hold the attention of the class that is concerned with a given department of professional and industrial activity unless he is in close touch with the technique of the work done by that class and the purpose to which the work of that class is devoted; indeed, such sympathetic understanding between an editor and his readers is essential to the maintenance of a satisfactory and mutually stimulating relationship.

The editor has three distinct functions to perform: he revises the manuscript sent to him for publication, he assembles and arranges the various items required to make a complete issue, and he himself writes the articles of comment and criticism that are called 'editorials' in this country and 'leaders' in England. In performing this last function he plays the part of a self-appointed teacher in so far as he addresses a group of people whom he wishes to inform and to influence, but he is more fortunate than the pedagogue or professor in that he addresses himself to grown men, to his contemporaries, to men of wide experience and mature intelligence, so that he receives from them not only the direct help of articles and correspondence, but the mental stimulus of an appreciative and understanding audience. Upon the establishment of this relationship will depend his success as the conductor of a journalistic enterprise.

The Treaty and the Senate

A treaty is "a formal agreement or compact, as between two nations." An *agreement*—that essential will bear stressing. A treaty is not the will of one nation imposed upon another, except in the case of an opponent so utterly vanquished as to have no alternative but to accept the terms imposed. That was the case with the Central Powers; it was not the case among the Allies. Among themselves, the Allies were on an equal footing, if not in a military way, at least in the desire to be fair to each other and to avoid the seed of future wars. Each had certain requirements necessary to its safety or future development, and many of these requirements were conflicting. Italy wanted Fiume; Jugo-Slavia wanted a port; France wanted protection against the aggression that had twice crippled her; England wanted security for her colonies; Japan wanted a free hand for her development in the East; the United States wanted freedom from unstable conditions that would provoke further wars in which she would be inevitably entangled. To complicate the matter many secret treaties, entered into during the early part of the War, were in existence, treaties that could not be arbitrarily abrogated without a surrender of those principles of the sacredness of a plighted word that was one of the things for which we fought. We could not forget the 'scrap of paper'. The problems and conflicting desires discussed in secret sessions at Versailles must many times have seemed almost insurmountable. And out of this maelstrom of clashing interests, this strange entanglement of nations and even races of opposed ideals, a miracle was wrought: an agreement was reached. That little coterie of men, each the ablest his country could put forth, and on whom the peace and well-being of the world, perhaps for generations, depended, compromised their difficulties, and finally emerged with a document accepted by them all. Each had abandoned certain claims in return for other concessions, until a balance was obtained. The remarkable nature of this feat ought not to be overlooked. But it is being overlooked, if we may believe that public opinion is accurately represented by press reports and the comments of intelligent citizens. The United States, in the Treaty and the Covenant of the League of Nations as they now stand, has not obtained everything she desired; but neither has any other nation. In the very nature of the problem such an accomplishment was impossible. Nor would it have been desirable. One nation that was sufficiently strong to force through a treaty favorable to itself out of proportion to the others would have been offset by other nations that did not obtain their share of what they fought for, with the result that they would have tried to balance the account at a later date. No; compromise was the very essence of the negotiations at Versailles. Let us remember that. If we believe that during the negotiations at the Peace Conference the men who represented us succeeded in having a treaty drawn that embodied a reasonable share of those ideals for which we fought, that with consideration for the rights of other nations we did not come off badly in the inevitable compromises, then we should think soberly before we unlock again a veritable Pandora's box of opposed ideals and conflicting jealousies, while a disrupted world awaits the opportunity to return to peaceful pursuits, and famine and disease stalk unchecked in Europe. It does not require a keen mind to point out elements in which the Treaty and the Covenant as they stand are not as favorable to the United States as we could have wished, or to formulate amendments that would be more favorable to us; but to make other nations accept such revisions would be a different matter. Our politicians have been more than busy suggesting amendments; formulating new treaties and covenants in the quiet of their studies and pouring them forth, surrounded with much oratorical flub-dub, upon an all but exhausted world; forcing our President to tour the country in defence of a Treaty for which he fought through many months at Versailles. The reason is clear: politics that, except in rare instances, has placed personal spite ahead of a speedy settlement of the turmoil that has racked the world for five desolate years. The split of the vote in the Senate on party lines points to this, as does the statement we so often hear that President Wilson slighted the Senate by not consulting it as the co-ordinate branch of the treaty-making power. If the President were of the type that consults easily with men with whom he is not sympathetic, and if he had taken with him to Versailles four or five influential Senators wisely selected from the party opposed to him, there is more than a suspicion that he could have returned with the same Treaty and Covenant, the Senate would have fallen into line behind its leaders, and ratification for both would have been obtained easily. That is the discouraging part of the whole wretched business: not that the Treaty or the Covenant is a compromise that, drawn up with due regard for the conflicting rights and desires of other nations, does not give us everything we want, but that party politics, jealousies, and spite can smother ratification in a mass of frothy oratory while Europe trembles on the verge of anarchy.

The Miner and the Protective Tariff

The Editor:

Sir—Must I apologize for re-opening the century-old discussion on the tariff? It is my purpose to show that the metal-mining industry, at least that portion that interests the Western miner, has been laboring under an unjust and insidious discrimination during the entire period of its development. That the mines have never been looked upon as "infant industries" and that their products have never been objects of solicitude on the part of the politicians at Washington, need not be told. What follows, it is believed, will make clear that to be ignored under a protectionist policy is to be discriminated against, and if any class of men has been ignored in the tariff juggling of the past, it has surely been the Western miner.

In order to study the effects of a tariff upon an unprotected article, silver will be used as an example, as it has never been favored by a protective tariff. That the silver miner is in full competition with the world it is not difficult to understand, for it is obvious that he must sell his product, whether at home or abroad, at the same prices, and under the same conditions as the foreign producer. When it is realized that, at the same time, he must purchase his supplies behind a tariff wall and must pay the high artificial scale of prices and wages usually prevailing under such conditions, one can appreciate that the policy of protection has been anything but a benefit to the silver miner.

Under the present tariff law, which represents the last revision 'downward' there is a duty on tools of 10%, engines 15%, rails 15%, cyanide 25%, automobiles 45% *ad valorem*. These are all articles used by the miner, and, being behind the tariff wall, they take on the usual artificial scale of prices. When these articles are purchased in free-trade countries, other things being equal, they are materially cheaper. Hence we find that our silver miner, and the miner of any other unprotected mineral, operates under an unjust, although indirect, discrimination.

The gold miner is also affected by the same cause. The fact that his product has a fixed selling-price may lead to the belief that he escapes this influence. If, however, we consider that the Rand miner may purchase in a free-trade market, while we remember that our Mother Lode miner must purchase under tariff restrictions, we cannot fail to see that the South African operator has a distinct advantage, and that if the Californian could purchase in the open markets of the world, he could easily make larger profits.

The argument that prices are kept down by inside competition in the United States may be advanced, of course; but the disclosures of recent years, especially those of Miss Tarbell, should negative this idea. Indeed, we have but to look in an issue of some months ago of the 'Engineering and Mining Journal' to get a hint as to where the shoe pinches. Here we find a clear illustration of what we have been discussing and which we may term protective 'back-fire'. The tungsten miners foreseeing a big drop in the price of their product, sought Government aid. It was refused by the War Trade Board, the following being given as the reason, according to the 'Journal'. "To grant protection," the Board holds, "to one American industry, and possibly affect adversely other industries is without its province." The tungsten producers want protection in order to hold up the price. The powerful steel interests must pay the increased price, and accordingly increase the cost of production of steel just that much. The disadvantage of purchasing in a restricted market is here keenly felt. The view of the War Board was undoubtedly justified. They had no right to discriminate in favor of any one, but the point is, they clearly see the discrimination, and if it exists in that case, how can it be that the purchase of a multitude of articles in a protected market is not also a discrimination?

The conditions just outlined for gold, silver, and tungsten apply also to copper and the other so-called raw materials of the United States. They are either on the free list, or have the benefit of only a low tariff, and are under the usual necessity of purchasing within a protected market. It should now be obvious that the indiscriminate application of high protective tariffs is not an unmixed advantage. Protection concerns itself with the seller—seldom indeed, does it consider the buyer—although a low price may be as vital to the latter as a high price is to the former. It would indeed be interesting to know how many men have met financial ruin by insidious increases in costs due to the tariff juggling of the past fifty years.

The present tariff protects lead and zinc to a small extent, but not to a point where it may be said that these metals receive the average protection; and here it may be pointed out that any article that does not receive what for convenience may be termed an average degree of protection is laboring under discrimination. The formulation of a just tariff, even under the most favor-

able circumstances, is, in the very nature of the case, an impossible task. However, this wholesale method of discriminating against the producers of the 'raw materials' in general, and the miner in particular, should be called into question.

For years the miner has struggled along under this discrimination. He has been the unconscious 'goat' in wholesale class legislation. He has not been alive to the burdens that have been placed upon him. His position is similar to that of the English manufacturer before the abolition of the Corn Laws a century ago. At that time the English were encouraging agriculture by protective tariffs. They had anticipated our more modern methods of robbing Peter to pay Paul. These manufacturers, finally enlightened by the then recent great progress in the science of political economy, began the battle for relief. They had the further aid of English statesmen who had some attributes besides those of the glad-hand politician.

The Corn Laws were repealed. English manufacturing, which had languished, began to take on new life. The heads of these industries soon learned the importance of being able to reach the farthest and cheapest corners of the earth. Supplies for every class of work, mining included, began to pour into England. Ships laden with the products of North and South America, the Orient, Africa, and continental Europe sailed freely into her harbors; and as freely sailed out, bearing in payment a part of the same raw materials that they had brought in, but now having them fashioned into new forms, prepared and finished for the further use of mankind.

The following quotation is given at length as it is illuminating, and is an epitome of almost the entire question before us. Its author was F. W. Hirst, the editor of the London 'Economist', and he was writing, not to influence Americans, but to guide English investors who might contemplate the purchase of American securities, and which might be affected by the American system of protective tariffs. He said: "Sixty years ago, indeed, Paris was still a formidable rival in finance, and the United States in shipping. But just at this critical moment England adopted the policy of a free market for gold and all commodities. A sound currency and an almost perfect banking system were firmly established at the same time that perfect freedom of importing and exporting was given to the whole nation. In the course of a few years all protective duties, and all duties upon exports such as coal and machinery were entirely removed. Our trade advanced by leaps and bounds. British shipping expanded at such a rate that before the end of the century it actually represented, and still represents (1911) roughly, half the world's mercantile marine. The United States after the Civil War adopted an exactly opposite policy of restriction. Prices were artificially raised. The high tariff wall, which was erected to exclude foreign competition, raised the cost of production. American manufacturers were unable to compete in neutral markets, and the American mercantile marine, which had threatened to rival and out-distance ours, dwindled into insignificance."

This brief review of British tariff history brings out vividly some of the weaknesses of a protective tariff. As a matter of fact, it is an assault upon the whole system. Our interest here, however, is concerned with the effects of protection upon the miner. Gold and silver seem to be beyond the possibility of aid from tariffs; they must suffer as long as the tariff endures. The position of copper is no better, unless the miner exerts enough power in Congress to obtain protection sufficient to enable him to sell copper at one price at home and at a lower one abroad. This is probably impossible; so copper, like gold and silver, must bear the burdens imposed by the tariff, and without any hope of participating in its benefits. On the whole, the tariff has been and apparently must be inimical to the interests of the miner, and while it appears impossible to suggest any remedy in many cases short of a free-trade policy, still an understanding of the indirect effects of the tariff should arouse the miner's opposition to any future attempts to place the country behind such high protective barriers as have been common in the past.

CHARLES A. PORTER.

Tecoma, Nevada, August 25.

The Crowe Process

The Editor:

Sir—In your editorial comment on Dr. Keith's article, in the issue of August 23, you express the opinion that the general idea of de-aerifying cyanide solutions preparatory to precipitation, recognized vaguely in the literature of the subject, was not enough to support Dr. Keith's contention, "but the application of the idea to milling practice, specifically by removal of the dissolved oxygen by means of a vacuum, is quite another matter." Perhaps it is, hence the object of this note is to show specifically such application extending back over 11 years practice.

I was much impressed by Caldecott's article* showing that highly aerated cyanide solutions dissolve off the filiform zinc from gold already deposited, for the reason that I had a somewhat similar experience in a large mill where for a period of nearly three days the solutions emerged from the zinc-boxes with increased gold content—the gold being dissolved in the precipitators—but its solution was not due to excess air. Nevertheless Caldecott's work was duly noted for future use.

Shortly after the introduction of zinc-dust precipitation by Merrill, I was shown the operation of his process in the Homestake mill. Compressed air was used to agitate the solution and zinc-dust in an open vat, prior to pumping the mixture into the filter-presses. That system of agitation was subsequently abandaned for the very reason pointed out by Caldecott (quoted above), or as Rose neatly puts it, "the air agitation, however,

*W. A. Caldecott, Proc. Chem. & Met. Soc. S. A., Vol. 2, page 747, 1899.

tended to defeat its own object, one effect being to redissolve the gold."† Here then we have ample warning against the use of a strongly aerified solution, covering the use of filiform zinc and also zinc-dust in the precipitation of gold from cyanide solution, dating away back to the days of decantation or mechanical agitation of slime, including, of course, the leaching-vats that have always been with us. In my own experience the charges in the leachers proved very good absorbers of oxygen; I cannot recall having any particular trouble or expense in precipitating the percolate therefrom even after sending compressed air under the filters to furnish a fresh supply of oxygen to the depleted cyanide solution. A mill-superintendent, who had some trouble through drain-pipes choking with sand passing worn filters, increased the drop of the main drain-pipe and put in a small air-lift to boost the solution into the collector at the head of the zinc-boxes, without, I was informed, any noticeable effect in the precipitation. I do not approve the method, merely offer it as evidence that solutions from deep vat-charges will under certain conditions stand a little aerifying without materially affecting precipitation on filiform zinc.

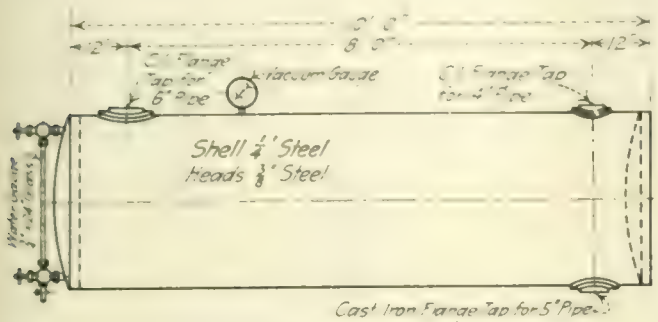


FIG. 1. RECEIVER FOR DE-GASSING SOLUTIONS

With the introduction of air-agitation, however, came, as one might naturally expect, the loading up of the solutions with gases and shortly afterward came the remedy, to those wise enough to apply it correctly. I refer to the vacuum-filter, in my opinion the greatest mechanical advance in slime treatment in the history of the cyanide process. The cheaper and more easily applied method was the wet vacuum in which a single pump pulled the mingled solutions and gases through the apparatus and discharged them to the precipitators or storage-vats. The dry-vacuum process, however, is far superior, though somewhat more expensive to install; it requires an ample receiver, an air-pump to pull out the gases from the filtrate, and a solution pump or barometric pipe to remove the de-gassed filtrate from the receiver. It follows that those operators who installed receivers or de-gassing-vats, as we might more appropriately call them, of ample proportion to make a practically complete separation of the gases from the liquid, have enjoyed the advantage of what has lately been called vacuum precipitation.

†T. K. Rose, 'The Metallurgy of Gold', sixth edition, page 381.

In 1907 I designed my first plant for air-agitation of slime followed by vacuum-filters of the leaf type. The plant had a capacity of 5000 tons per month, or about 3000 tons of slime, and on reference to Fig. 1, a print from drawing No. 110, Stratton's Independence mill, dated January 8, 1908, it will be seen that provision is made for de-gassing the solutions in combination with the operation of the filter. This apparatus was given a trial run in April 1908, and during the following year it was placed in continuous service.

The de-gasser was connected with a 16 by 10-in. dry-vacuum pump through a stand-pipe 21 ft. 6 in. to the return bend leading down to the pump, a height deemed ample at an elevation of 10,000 ft. above sea-level. The evolution of gas, however, proved so vigorous that foam occasionally passed over into the air-pump. So the stand-pipe loop was extended through the roof of the mill and became at once an object of curiosity and comment. The header from the suction-filter was connected direct to the gas-separator and the de-gassed solutions removed therefrom by a two-stage centrifugal pump, set 8 ft. below the solution level of the separator, which delivered the solutions to the clarifiers from which the de-gassed solution was piped to the old reliable zinc-boxes.

Regarding the results obtained from this apparatus, I quote part of an official report addressed to the directors of Stratton's Independence, Ltd., under date March 17, 1910:

Itimized milling cost, Stratton's Independence, Ltd., Victor, Colorado, compiled from milling 29,877 tons, in half-year ended December 31, 1909.

CYANIDE DEPARTMENT

		Per ton milled
Labor	7532 61	0.2521
Supplies, general	1690 52	0 0566
Repairs, labor	788.65	0 0264
Repairs, supplies	453 07	0.0151
Pumps	135.30	0 0045
Power	1730.00	0.0579
Insurance, accident	93 29	0 0031
Insurance, fire	739 02	0.0247
Taxes	594 73	0.0199
Cyanide	3689 00	0.1235
Bromo-cyanogen	2401 77	0.0804
Zinc	490 00	0 0164
Acid	163 08	0 0054
Lime	530 77	0 0178
Coke	61 65	0.0021
Fluxes	144 69	0.0048
Chemical reagents	104 04	0 0034
	$21,342.19	$0.7141

The weight of chemicals used is not shown, but can be easily ascertained on reference to current quotations for 1909. Zinc probably cost 9 or 10 cents per pound; if the latter, say, 0.164 lb. zinc per ton of ore milled, so far as I know the best record at this mill.

I shall not at this time refer to later practice except to state that when the mill was enlarged a second filter-

vat was installed and a similar de-gassing vat, but this one was placed vertical, its base 7 ft. above the pump, the header from the filter entering 2 ft. below the top so that the filtrate might spray across the vat and cascade down to the solution level. The two de-gassers were so connected that each filter had its own de-gasser and centrifugal pump, yet both filters could be operated from either de-gasser, while the original air-pump served both filters and de-gassers for the entire period, April 1908 to June 30, 1915, when the Independence mill was sold as a going concern to the Portland Gold Mining Company.

This de-gassing apparatus was not set up in a celler or behind locked doors, it was out in the open mill in full view of the many visitors, and to my knowledge no interested person was ever denied admittance to the mill or an explanation of our practice. The zinc-boxes passing solutions from the leaching-vats and showing at times some of the white precipitate were in full view, as were also the zinc-boxes passing the de-gassed solutions invariably free of such precipitate.

I have not seen the patent from which three claims were quoted in Dr. Keith's article, which claims in the light of cyanide practice during the last decade look like a ghastly joke; yet I doubt if it matters much, for few laws are retroactive and patent claims can scarcely be so classed; anyhow, the design described herein will accomplish for others the same service as it rendered in the Independence mill; its use is as free as the air that it pulled out of over a million tons of cyanide solution in the said mill, including oxygen and, of course, nitrogen, helium, argon, neon, bromine, carbonic acid, etc., whose influence on precipitation is, so far as I know, yet in the womb of future chemical research.

PHILIP ARGALL.

Denver, August 27.

Conventional Symbols for Mine-Maps

The Editor:

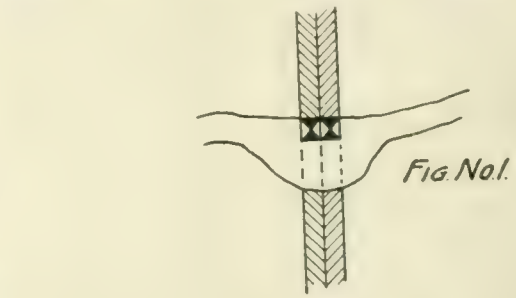
Sir—I have read Professor Uren's article in your issue of August 16 with considerable interest, as I have devoted some time to an effort to develop a practical set of map symbols that will conform to general practice. There are a few criticisms of Professor Uren's conventions that should be considered from the draftsman's viewpoint before any effort is made to secure their general acceptance.

First, it should be borne in mind that a great deal of mine-mapping is done by men who are not skilled draftsmen, and, secondly, it is usually desirable to prepare maps in such a form that tracings can be made for blue or brown printing. Therefore symbols should be forms easily and quickly drawn with as little use of colored lines as possible. Attention to these two points will save a great deal of time in the drafting-room and will make the engineer in the field more inclined to accept suggested standards.

Several of Professor Uren's symbols are unnecessarily elaborate and could be replaced with much simpler conventions. This applies especially to the geological conventions. On colored maps, while yellow has good printing qualities, its use is undesirable for such important features as contacts, faults, and veins, owing to the fact that yellow-ink lines do not stand out well on a drawing, especially under artificial light. Blue for faults and red for veins are preferable. On large-scale maps, where buildings are to be shown in color, the system of the Sanborn Map Co. should be followed as closely as possible, as it is used for all insurance maps throughout the United States. Their colors are as follows: Wood, yellow; brick, red; stone, blue; iron, gray; adobe, brown; others, green.

Professor Uren omits several important symbols, such as sample-cuts, inaccessible workings, etc.

Unless contour-lines are so crowded as to obscure other information on a map, they should be drawn in black. When they are shown in color on tracings intended for



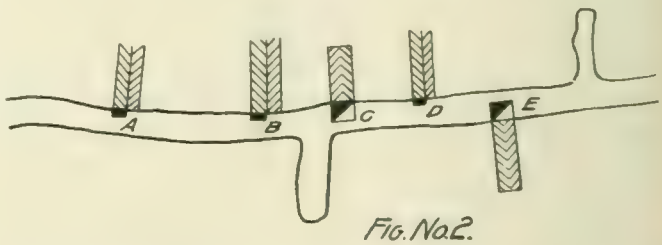


Fig. No. 2.

blue-printing, brown ink should be used. If blue or brown line prints are to be made, use orange. Features of minor importance can be in carmine. Yellow, orange, and vermilion print nearly as well as black, whereas blue, green, and violet make very poor prints. Colors are unnecessary on most maps except when geology is to be shown without obscuring other features. When prints are to be colored, all black-ink work on the tracing should be done first, and a negative made, after which the colored lines may be added to the tracing. The colored lines may then be copied on the prints by working over a glass plate. The areas of various rock formations should be filled in with washes of solid color arranged to secure as much contrast as possible. In addition to the colors used, all formations should be identified by abbreviations, such as the U. S. Geological Survey uses on its maps. Faults and fissures can be shown with blue lines. Mineralization can best be shown with irregular lines and dots of carmine for gold and silver, brown for iron or manganese, and green for copper.

J. H. MARION.

San Francisco, August 27.

BOUNDARIES AND MONUMENTS

- National or State Line
- County Line
- Township
- Section
- ¼ Section
- 1/16 Section
- Reservation
- Land Grant
- Property
- Survey Base-line
- Survey Line
- Right of Way
- City Limits
- Transit Station
- Triangulation Station
- U.S Mineral Monument
- Bench mark B.M
- Section-corner or Monument in place

TRANSPORTATION LINES & STRUCTURES

Railways
- Existing Steam
- " Electric
- " Steam and Electric
- " Car Lines & Ry Tracks
- Proposed Steam
- " Electric
- " Steam and Electric
- " Car Lines & Ry Tracks

- Surface Tram
- Aerial Tram
- Road
- Proposed Road
- Private or Abandoned Road
- Trail
- Steamship Lines
- Canal or Ditch
- Proposed Canal or Ditch
- Flume
- Pipe Line
- Telegraph Line
- Electric power Line

- Fence
- Hedge
- Bank or Retaining-wall
- Levee
- Dam
- Bridge
- Drawbridge
- Ferry
- Ford
- Reservoir
- Trestle
- Buildings
- " proposed or removed
- Water wells
- Oil wells Drilling
- " " Dry
- " " Producing
- " " Abandoned
- Tanks

TOPOGRAPHY AND HYDROGRAPHY

- Contours
- Trees
- Bushes
- Grass
- Marsh
- Tide Flats
- Rocky Ledges
- Sand
- Gravel and Rock
- Rock under water + awash
- Life Saving Station
- Lighthouse (or Light at ... head)
- Light vessel
- Buoy
- Anchorage
- Streams, large , small
- Intermittent Streams
- Springs

MINING

- Claim lines and Corners
- Shaft Timbered, Collar of Compartment, Below Surface
- " Small Scale, Abandoned
- " not Timbered at Collar
- Winze
- " Holed Through
- Raise Timbered
- " " Holed Through
- Chute
- Incline or
- Drift without Timber
- " with "
- Workings above Plan or in front of Section
- " below " " back " "
- " on Plan or Section
- Tunnel cut by Cross section
- Inaccessable Workings
- Stope
- Limit of Monthly Progress in Stope
- Dump and Car Track
- Tunnel small scale or
- Mine or Quarry
- Prospect-pit
- Croppings
- Placer-ground
- Sample Cut Horizontal
- " " Vertical
- Diamond-drill Hole Inclined
- " " " Vertical
- Churn-drill Hole
- Open-cuts
- Strike and Dip of Vein or Fault
- Horizontal Bed
- Vertical Strike and Dip
- Dip and Strike of Sub-stratum
- Vertical Dip and Strike of Sub-stratum
- Known Contacts
- Probable Contacts
- Faults, blue if colored
- Vein, red if colored
- Orebody

Of Dr. Day

It is one of the most widely [illegible] used by the U.S. [illegible] not used. They are [illegible] for mining, the names given here being only intended as suggestions. The only rule to be observed is that the symbols shown for sedimentary formations should not be used for igneous or metamorphic rocks.

Sand, Clay, Country Rock, Slate, Coal, Limestone, Sandstone, Granite, Syenite, Trachyte, Andesite, Porphyry, Basalt, Conglomerate

STANDARD SIGNS

FOR USE ON

MAPS AND PLANS

COMPILED BY [illegible]

DRAFTSMAN

Sampling Large Low-Grade Orebodies

The Editor:

Sir—I have been a close student of the discussion on sampling and was much impressed with the combination method evolved by Morton Webber. However, I have felt that some of the engineers who have written articles on Mr. Webber's combination method have erred in criticizing it by attempting to apply it to mines to which, from Mr. Webber's writings on the subject, it is evident he would not attempt to apply it himself. For example, Mr. Sleeman attempts to apply it (and thereby attempts to exhibit its shortcomings) to a mine evidently in the transition stage of secondary enrichment.

The combination method, if I have read the discussion correctly, was evolved by Mr. Webber for the sampling of large low-grade gold deposits, such as the Alaska Gastineau, where great accuracy in sampling was fundamental; where a sampling error of, say, 40c. per ton would mean the difference between profit and loss. Having a fair knowledge of Alaskan conditions, I infer that secondary enrichment would not be important, because secondary enrichment in such deposits is practically absent. There has been leaching of solubles at the top which increased the original gold content, and the gold content decreases with depth as the leaching of solubles became less marked, but I think you will agree that this is not secondary enrichment as described by recognized geologists such as Lindgren or Van Hise. I agree, therefore, with R. Raymond in his contribution on the subject that had this method been employed in such an example the enormous capital loss would have been prevented, or at least a large part of it.

To attempt to criticize Mr. Webber's combination method by assuming its application to mines of a different type is illogical. In the large low-grade gold deposits for which this combination method was intended, the sampling error, in my opinion, will be found to be either generally small or generally great. It will not jump about from place to place, as would be expected in a mine of the bonanza type, which as a rule owes its existence to secondary enrichment. The trouble in the case of the Gastineau, and other similar deposits with which I am familiar, was in the inability to determine whether the sampling error was large or small, would the mill-feed as a whole stand up to sampling or would the deposit as a whole show a sampling error that would wipe out the profit.

It seems to me that this combination method would also apply to a large number of low-grade mines whether of gold or copper; I refer to the deposit, either of gold or copper, of large dimensions that is just on the border of the cost-line, the deposit that requires enormous capital expenditure to put it on the map. Careful hand-sampling may show a profit of, say, 50c. or $1 per ton provided the mill-feed proves to be the same as indicated by hand-sampling. However, this vital point, if hand-sampling is solely relied upon, cannot be disclosed or determined until the final investment is incurred—as at the Gastineau. Mr. Webber's combination method would show the sampling error as the mine was being opened up and the people putting up the money would realize at a reasonably early date, taking into consideration the size of venture, whether or not the mill-feed would stand up to expectations, how far it was likely to fall short, and if the shortage would wipe out the expected profit. The combination method therefore would seem to me to be of incalculable value in such a deposit and it seems fatuous to apply such a system to mines for which it probably was not intended.

There remain a few points of importance which have not been sufficiently dealt with either by Mr. Webber or his critics. They are: (1) The method of taking the bulk sample, that is, the weight of ore to be removed for each individual mill-test and the method of hand-sampling it during removal; I mean the sampling of the "successive backs" in order to obtain the sampling error, to correct the hand-sampling for the zone. (2) Discussion on the method of determining the size of a zone to be governed by its mill-test. In your editorial of May 2 you indicate that Mr. Webber would space the mill-tests at equal distances throughout the deposit. I do not gather that Mr. Webber has suggested that the ore for the mill-tests would be taken at regular intervals. He has stated that the distances apart would be determined on the evidence of the individual case. To me, the discussion seems to lack a good deal of information on this important phase; Mr. Raymond wrote constructively on this part of the subject, but on these matters there seems to be a good deal left to be said, and I think is would be extremely valuable if this phase, such a vital step in sampling, could be further enlarged upon by either Mr. Webber or some other engineer.

Butte, August 19. A. R. Pierce.

The Nelchina-Susitna region, southern Alaska, which covers the headwaters of the Copper, Matanuska, and Susitna rivers, though more accessible than many parts of Alaska that are much better known, had not been fully covered by Government surveys until a few years ago, when a party from the U. S. Geological Survey examined and mapped the unsurveyed areas in that region. There has been but little productive mining in that region, and its geology does not encourage the hope that much placer gold will be found there, but gold lodes may yet be discovered at some places. The region will be made accessible by the Government railroad to the Matanuska coalfield, and its systematic prospecting for gold placers or lodes may perhaps be warranted. A report on the region, by Theodore Chapin, geologist, has just been published by the U. S. Geological Survey as Bulletin 668, under the title 'The Nelchina-Susitna Region, Alaska'. The report sketches the geography and geology of the region and contains topographic and geologic maps covering about 10,000 square miles as well as half-tone views, and includes brief notes on the work done on placers. The report can be obtained free of charge from the Director of the U. S. Geological Survey at Washington, D. C.

A Metallurgical Journey to Shasta, California V

Smelter Fume. The Fields and Hall Process. Flotation Concentrate.

By HERBERT LANG

A large volume of smoke is evolved at the Kennett works. Computation will shed light upon its bulk and composition, and inferentially upon the comprehensiveness of the means required for handling it. Certain assumptions may be made for convenient calculations. We may assume a daily duty of 1000 tons only, of which 30%, or 300 tons, consists of iron, wholly in the form of pyrite; 4%, or 40 tons, of zinc, in the form of blende; 30 tons of copper, wholly in the form of chalcopyrite; and that no other mineral constituents than these require to be oxidized. The fuel requirements are 8% of indifferent coke, which hardly contains more than 80% carbon. Disregarding the production of sulphate and the waste of oxygen in the blast-furnace and the converter, and the vast quantity of 'false' air drawn into the converter and furnace-flues and passed into the bag-house system, we have as minimum requirements these amounts of oxygen:

	Tons
To convert the sulphur into the di-oxide	342
To convert the iron into protoxide	85
To convert the zinc into protoxide	20
To convert the carbon into di-oxide	170
Total oxygen	617

To obtain this amount of oxygen requires the blowing in of 3085 tons of air, or a little over three tons to each ton of charge—a quantity largely in excess of what is deemed the average requirement in the pyritic process, which is 1.75 tons per ton of charge. In this case—largely hypothetical—the oxidation is abnormally extensive, and the heat requirements are much exceeded.

The Mammoth plant, after a long and uninterrupted career of usefulness, closed its doors on the 18th of May of this year, on account of the strikes. For several years it had been running on sufferance. Involved in the fume difficulties that caused the ruin of the neighboring smelters, it had been allowed to run under conditions of compliance with certain restrictions deemed impossible at the other plants. A quasi-legal enactment, borrowed from the Utah courts and enforced in Shasta, provides that the smoke shall be freed from sulphur tri-oxide, and that the proportion of the di-oxide in the effluent gases should not exceed ¾%. The fixation of the former is not difficult, but it is costly in proportion to the amount of tri-oxide present, the lime required for neutralization being in the proportion of 7 parts to 10 parts of tri-oxide. The di-oxide is unaffected by the bag-house treatment, and passes into the atmosphere in much greater proportion than is admissible under the terms of the enactment. Dilution of the fume with air is therefore essential. This is accomplished by means of subsidiary blowers, which add an enormous bulk to the gases before their escape from the smokestacks.

This expedient of diluting the gases is so obvious that it is somewhat remarkable that the neighboring smelters did not avail themselves of it. It does not, however, obviate damage suits, since the court decision permits the prosecution of such suits whenever damage can be proved; for it is considered that even this small proportion of di-oxide (about one part in 133) might prove prejudicial to crops.

Twenty years experience and study of the fume problem have neither brought its solution nor settled men's opinions as to the damage caused. The question in its more important aspects therefore remains as at first. No new remedy of thorough efficacy against the effect of the sulphur gases has been put into use, though many of possible utility have been proposed. As regards the effect of the di-oxide upon vegetation, something has been ascertained by experiment and some qualitative results have been reached. A great deal of money has been expended, in experiment, in litigation, and in the settling of claims, many of which, perhaps the most, have been founded on injustice. As in most such circumstances a popular sentiment inimical to the smelting industry was carefully built up by interested persons, among whom lawyers out of a job took the lead, and conducted an active opposition, which can hardly be characterized for the most part as anything more than a blackmailing campaign, the upshot of which was the closing of all the smelters in Shasta but one. As for the more honorable and intelligent part of the community, they, while recognizing that some damage has always accrued, make light of it, and even see in the effects of the smoke on certain insect pests a positive advantage. Evidence is not lacking to prove that orchards at a moderate distance from the smelters have improved during these years, in consequence of the smoke—an admission which shows commendable candor. On the other hand, the casual visitor, impressed with the desolation existing along the gorge of the Sacramento, is apt to take a too desponding view, and assume more serious and long-continued damage. For it is along the railway track and in the immediate vicinity of the smelt-

ing works that the greatest harm has been done, and it is precisely this area, as adverse fortune will have it, that is most visited by the stranger. In the hilly region, where the destruction of vegetation has been fairly complete, a secondary effect of some importance is noted. Divested of its protective covering of trees, brush, and herbage the blanket of loose soil, unprotected from the storms of winter, has become furrowed by thousands of little watercourses, like wrinkles on the countenance of age. The soil, agriculturally considered, could never be supposed of much value, but it is rather a pity that it should be lost. Nature will doubtless take her own method of repairing these slight ravages, helped perhaps by some well considered scheme of scientific re-forestation.

Since the measurable extinction of smelting in Shasta county has robbed the subject of furnace-smoke of its local importance, it is scarcely worth while to speak in detail of the efforts that were made there to control this troublesome product; but two of these attempts possess even now enough interest to command attention. These are the processes known by the names of the inventors, Fields and Hall. The first aimed to remove the sulphur di-oxide by cooling; the other was designed to prevent the formation of the di-oxide, obtaining instead the elemental sulphur, which, besides being innocuous to organic life, is a saleable product. I shall speak of the Fields process first.

The condensation of sulphur gas by the application of cold and pressure is a practical, or at least possible, means of rendering smelter gases harmless; indeed, it is a method by which, under certain circumstances, the condensed product may become an article of industrial importance. The process consists in subjecting the purified and concentrated gas to a temperature low enough to cause it to assume the liquid form, when it is placed in stout iron vessels, to be sealed up and transported to market. Various uses have been found for it when thus prepared, but they are so circumscribed that only a few hundred tons per annum is sold in the United States, and scarcely more in Europe. The Fields process, which was tried at Redding a few years ago, is founded upon this principle, but the experiments were made with such inadequate apparatus and carried on with so little reflection as to the ultimate outcome that they failed completely, with a loss of some thousands of dollars. The central idea was to pass the fumes of the roasting sulphides through a long horizontal flue, and cool them in bulk, whereby the sulphur di-oxide was to have been condensed to a liquid, to be collected apart from the remaining constituents of the smoke. In thus attempting to cool the whole body of the gases a mistake was made. The procedure should have imitated that of the Somerset company, in New Jersey, whose method, imitated in turn from the Germans, consisted in first collecting the di-oxide in water, by which it is dissolved and separated from the other constituents, and afterward heating the watery solution to expel the di-oxide, which is thus obtained entirely free from the other gases and solids with which it must have been associated. The procedure is entirely analogous to that by which the liquid carbon di-oxide, so much used in connection with the beer industry, is prepared, and it is not at all difficult. In this instance the paucity of demand is the great difficulty—a difficulty not to be overcome until the commercial requirements shall have greatly increased.

The Hall process was tried in 1914 at the plant (generally known as the Balaklala smelter) of the First National Copper Co. at Coram, under fairly favorable auspices, and with results that, although hardly to be called conclusive, seem to give promise of large usefulness. This process aims to desulphurize ores through the interaction of certain combustible gases, especially those containing hydrogen—either free or combined with carbon—directly on the sulphur, but by secondary reactions releasing the latter, so that the element is evolved alone and can be collected by itself. The chemical reactions are not fully understood, or at least probably have not been fully substantiated, although the effect of steam upon hot sulphides has been much investigated. It would appear from the experience at Coram that gaseous hydrocarbons act more readily upon the ore than does steam, and it would also appear that the familiar reaction between sulphur di-oxide and hydrogen sulphide, by which water and free sulphur are produced, played an important part in the Hall process. According to the statements of H. F. Wierum, the engineer in charge, the process, while receiving considerable modifications at his hands, met its best success when a quantity of crude oil, equal to from 6 to 7% on the weight of ore, was burned with a deficiency of air, thus producing a reducing atmosphere, and that the rate of desulphurization was nearly equal, in like furnaces, to that achieved in ordinary roasting. Even at this rate, we are told, the reduction of ore averaging 40% sulphur, was so nearly complete that only 2 or 3% was left. The exit gas contained but little di-oxide—so little, in fact, that it could hardly be detected by the smell. These results are certainly surprising. The apparatus chosen for the tests consisted of turret roasters of an ordinary kind, 18 ft. in diameter, one fitted up for using artificially prepared hydrocarbon gas coming from a producer, while another was provided with crude-oil burners. The latter arrangement, though not contemplated originally, is declared to have been the more efficient. The principal difficulties, consisting in the imperfection of apparatus, especially of the mechanical washer, which was expected to condense and remove the elemental sulphur from the fume, do not seem to have been of an insuperable character at all; and it is hard to see why the process was abandoned. Among the minor difficulties, Mr. Wierum mentions the formation of "certain undetermined organic sulphides," which interfered with the production of pure sulphur. This might have been expected, and it is not unlikely that the undesired products were those polythionic acids which arise from the reaction of the simple di-oxide on hydrogen sulphide, and which injuriously interfere with the practical success of that reaction.

In carrying out the operation in the turret furnace (a plain McDougall) it was found that the process was naturally divisible into two parts. First on the upper hearths there took place a desulphurization, which appeared to leave the metals in a comparatively unattached form, retaining some little sulphur, if we may infer so much from Mr. Wierum's account. This material, having become considerably heated, sinking to the lower hearths, was met by a rising current of air, by which it was oxidized thoroughly, as would happen in ordinary roasting. The hydrocarbon gases, being introduced at a higher level, exercised their effect upon what we may call the rawer portions of the charge, and meeting the rising gases from the lower part, which necessarily contain the sulphur in the di-oxide form, the before-mentioned reaction occurs, among others. This result was evidently not foreseen by the inventor, though it by no means detracts from the value of the method.

In comparing the Hall process with that of Cottrell, which was tried and abandoned at Coram prior to the time of which we are speaking, it would seem that they are in a measure the complement of each other. The Cottrell process removes from the fume the solid and condensable matters, but has no effect upon either the production or the arrestation of sulphur di-oxide. The Hall process prevents the production of the di-oxide, as well as of the condensible tri-oxide. It would seem, then, that the application of both at once should produce an effluent totally free from objectionable matter.

The idea of utilizing the reaction between hydrocarbons and sulphur is not especially new; since Schnabel relates in 'Metallurgy', Vol. I, page 209, that "Sinding generates producer gas with raw fuel and leads it over red-hot pyrite; by the consequent reaction hydrogen sulphide is formed," etc., etc. Reference to this reaction may be traced in other comparatively old publications.

The fume question, which was the cause of so much persecution and so much annoyance and loss, reached an indirect solution when the Mountain Copper Co., ever foremost in vital improvement, removed its activities to the neighborhood of Martinez and set about the manufacture of sulphuric acid from its sulphides. This move was dictated largely, no doubt, by necessity; but largely also by the prospect of finding economic use for a wasteful and noisome product. In this sense, then, the fume agitation was a blessing in disguise; since it was the means of building up an important industry, which in one form or another promises to endure so long as the mines that gave it birth continue productive.

The ores most in use for acid-making are the simplest class of pyrite, carrying a large proportion of sulphur, and consequently of iron, but not much copper. An ore containing 45% sulphur has not been difficult to procure, either in Shasta or in other mining regions, but much material is burned for this purpose that carries considerably less. The average content in copper is hardly above 1%, although this percentage is exceeded from time to time. The expansion of the acid trade here, as in other parts of the United States, has reacted in such a manner as to bring into use larger and larger amounts of base sulphides, but in California the acid plants have not yet advanced to the utilization of zinc-bearing material as elsewhere. For many years, however, a notable amount of acid has been made from concentrated stamp-mill tailing, which offers the same advantage as the crude pyrite; but this source of sulphur is unimportant. For a good many years the acid works around San Francisco bay, to the number of a dozen, first and last, have drawn a good proportion of their ore from Shasta, so that the utilization of it is no new thing.

For reasons that are obvious to the initiated, the manufacture of acid at the mines of Shasta has never been undertaken. In this regard it is sufficient to say that as a ton of acid requires the sulphur of less than a ton of ore, and as the acid would require to be shipped, at much higher cost than the ore, the local manufacture would prove unprofitable. The character of the ore thus far utilized in acid-making is superior as regards its sulphur content, but the residual matters left after calcining are almost negligible, consisting of a large proportion of iron, with but little of copper, and quite low in the precious metals. In large quantities the residue (cinder) contains 1% or less of copper, together with about one dollar in gold and silver. Such material is almost too poor to pay for smelting, and is discarded at once. Several large dumps of such cinder are now to be seen at the various acid-plants around the Bay, awaiting the time when the advance of metallurgical skill shall create a demand for this kind of material. Meantime some attempts have been made to extract the soluble copper by lixiviating the heaps with water. The extraction in such cases hardly surpasses 30 or 40%, and therefore is not especially profitable.

Sulphides of better quality leave a cinder that is invariably matted. As an example there is the flotation concentrate produced by the Mountain Copper Co. at its large plant at Minnesota, on the Iron Mountain railroad. Of this material some 70 tons per day, containing 15% copper, were made from 500 tons of ore averaging about 2% copper. This concentrate, after roasting, was smelted into a rich matte, which was then bessemerized in the usual way.

We may pause here to note that this company was the first to adopt flotation, as it was the first to introduce pyritic smelting and other modern methods. Its transfer of operations to Martinez marked a decided advance, and was a step which is likely to have an increasingly beneficial effect upon the mining industry.

Besides the Mountain Copper Co., two other companies have taken up the flotation method, the Afterthought and the Bully Hill. In their cases the conditions are far less favorable, owing to the peculiar composition of their ores, which have been sufficiently described, so that it will be unnecessary to say more now than that they consist of heavy sulphides with so little gangue that the proportion of matter 'lifted' by the process is almost one-half. Thus there can be no proper concentration, since the value of the concentrate could not be more than twice

that of the original ore. It would necessarily consist of a granular mixture running high in zinc, which if sold to the zinc smelters would subject the other metals to heavy deductions. On the other hand, if sold to copper smelters the presence of the abundant zinc would be found objectionable, in either event heavy losses being incurred. To avoid these difficulties both companies have instituted modifications of the flotation process that are extremely interesting and well repay investigation. Working on almost identical ore the two have projected and partly worked out methods differing radically.

At the Afterthought, where more than $500,000 has been expended in the construction of a splendid plant having a nominal capacity of 300 tons daily, the process consists in a preliminary pulverizing of the ore to a maximum of 40-mesh, and the floating of the sulphides, getting a product of 6% copper, with 30% and more of zinc. An unfavorable feature is the loss of two ounces of silver per ton, said to be due to the barite, which appears to contain that metal. This product, which amounts, roughly, to one-half the weight of the original ore, is dewatered and then dried in a revolving furnace, and, while still somewhat heated, is introduced into another furnace, this being a roasting-furnace in which a peculiar effect is sought. It being considered that as three sulphides, namely, those of copper, iron, and zinc, are present, and that the two former are more susceptible of oxidation than the latter, that by suitably governing the roasting the former might be provided with a skin of oxide by which, when subjected again to the flotation process, it would resist lifting, while the unattacked sphalerite would be raised and consequently separated from its associates. Accordingly, the slightly roasted material is again run through the cells, getting a zinc concentrate, while the cuprous material remains behind, and is gathered by itself. In this way two products are actually obtained, but without the distinct separation that was expected. It has been found practicable to get in experimental working a 35% zinc product, which is hardly satisfactory; but this product contained too much copper (about 2 or 3%) to lose; while on the other hand the copper product carried enough zinc to diminish its value appreciably. The success of the method depends upon the accurate running of the roasting-furnace. The matter of handling a furnace engaged in such delicate work as oxidizing only the surface of the iron and copper sulphides, while leaving the zinc sulphide intact, is unquestionably very difficult, and has given an able staff many sleepless nights; and there seems little room for hope that it will be accomplished in a commercial way. The apparatus is of the best, and its installation on such a scale shows the perfect faith of the management. It was found that a portion of the copper, through the application of too much heat or too prolonged subjection to the oxidizing effects, became sulphatized and therefore soluble. No trouble was found in recovering it from solution by the familiar method of precipitation on scrap-iron, but its effect upon pumps and pipes was said to have been serious. This objection, of course, is not difficult to overcome, while annoying for the time being.

The net result of the working at Afterthought has been the accumulation of over 7000 tons of flotation concentrate as yet unsold, of which 5000 tons is reported to contain 35% zinc, 4% copper, 6 to 8 oz. silver, and 30 to 40c. in gold. Another lot, estimated at 2000 tons, contains 22% zinc, 5% copper, and 8 oz. silver. What to do with this concentrate is a conundrum. Although there is a new and excellent reverberatory furnace just completed at the mill, it can readily be seen that no smelting method can deal with the problem on account of the excessive zinc. If favorable ores could be had to dilute the charge and bring the zinc down to a manageable tenor the stuff might be put through, but with a total loss of the zinc, and probably a poor recovery of the copper. There is no use in disguising the fact that the zinc must be eliminated before the other metals can be made available.

The method employed at Bully Hill differs from that described in that no roasting or other fire process is employed, but a kind of selective flotation is used, in which the two valuable products are obtained separately by the use of different kinds of oil, it having been found that they vary in their effects on this or that sulphide. Two froths are taken off, the one predominantly zinky, the other coppery. The foregoing analyses show the composition of the ore, but it may be remarked that the average proportion of sulphide in the ore thus far is 65%, the gangue consisting chiefly of silica, barite, and alumina. The zinc product amounted to one-third the weight of the original material, and assayed 45% zinc, with from 2 to 2½% copper; the copper product reached from 9 to 11% copper, with 15 to 17% zinc, and amounted in weight to 8 to 10% of the original ore. From this one would infer that the saving in copper was about one-half only, since the zinc smelters could scarcely be expected to pay for the quantity left in the zinc product, added to which the zinc in the 20% copper concentrate would not only be a total loss, but would subject the shipments to a penalty.

Hardly satisfied with the results of these attempts at flotation, the Bully Hill company has worked out a method of zinc recovery which parallels that employed for a time at the Mammoth works. The latter in 1918 made some 800 tons of very pure electrolytic zinc, the greater part of which sold under the designation of 'premium spelter' for a very high price, exceeding that paid for any distilled brand whatever. The idea that zinc can be made by electric means under the conditions prevailing in Shasta county needs no further demonstration, nor is it necessary to inquire why the Mammoth works ceased production after making so good a start So far as can be now seen the mining and metallurgy of zinc ores present almost the only means of keeping up mining activity in that region.

THALLIUM COMPOUNDS are widely distributed, but in very small quantities. The flue-dust of sulphuric-acid plants is still their only practicable source.

Technical Writing: Style

By T. A. RICKARD

*Technology has no recognized rank in what is called polite literature; the subject-matter of engineering is not supposed to lend itself to artistic treatment; we are the hewers of wood and drawers of water to the high-priests of learning who live on the cold summit above our humbler dwellings. Therefore the hierophants smile at the notion of 'style'—"that curiously personal thing"—in technical writing. The "great art" of Pater, the "inevitable phrase" of Raleigh, the "note of distinction" that Arnold demanded, are said to be beyond the scope, as they are supposed to be beside the need, of a writer on geology or engineering. This is a narrow view. Science, no less than *belles lettres,* calls for the highest flight of the human intelligence; the art of writing should be employed as skilfully and as thoroughly in a description of the structure of the Sierra Nevada, or of the construction of a tunnel through the range, as in a rhapsody welcoming the rosy fingers of the dawn.

The idea still lingers that fine writing does not befit technology, even though the masters of the Victorian period—Huxley, Tyndall, Ruskin—proved that science is worthy to be arrayed in the best robes that the looms of thought can weave. At the beginning of these lectures I quoted Barrie's remark touching the inability of the scientific man to express himself. That imputation has been passed to the technologist, whose utilitarian pursuits are supposed to make him too clumsy for the refinements of human speech. We may not have acquired the self-consciousness of those writers on Art whose "power of expression is so cultivated that their sensual caterwauling may be almost mistaken for the music of the spheres"; nor can we imitate the politicians, who have the ability to speak far beyond anything that they may have to say; but we too have a literature, a literature that is a gold mine of human experience, and we have a conscious aim to use our great inheritance, the English language, in furthering our purpose. Therefore, I submit, we are justified in discussing a matter even so recondite as 'style'.†

The engineer joins the essayist, the historian, and the poet in bowing to the greatest of all definitions of style: Buffon's "*Le style est l'homme même*"—style is the man himself. Good writing is natural; great writing is sincere. Artificial rules can no more furnish style than a man "by taking thought can add one cubit unto his stature." Not long ago I had the pleasure of editing an article on the discovery of cyanidation contributed by one of the originators of that process. The article was written without affectation, with a directness and a charm characteristic of the author of it. A correspondent in Australia wrote saying: "The charm of which you speak is characteristic of all good writing, whether on familiar or professional subjects. One might also conclude that such qualities of sincerity and kindliness alone can account for literary excellence." The persons concerned in this story are not famous—it was not Tyrrell talking to Carlyle about Swift, for example—but the episode serves to explain Buffon's saying "Style is the man himself." Buffon also said: "Ideas alone are the foundation of style," and Stevenson left a saying that is worth many rules: "If a man can group his ideas, he is a good writer." Without the ideas to bind his assorted facts, the writer fares no better than the Israelites in Egypt when they were expected to make bricks without straw. Given the ideas, the next step is to group them so as to achieve that "perfect lucidity" which Carlyle imputed to Swift. Then comes the search for the fitting word—"*le mot propre*" of Flaubert—the word that belongs to the thing described, the precise epithet. This was one of Shakespeare's great gifts. So, working backward, we have the proper word, the word in its right place, the idea that gives life to a sequence of words, and, behind all, the soul of a man.

You may have heard of the author that was obsessed by an unattainable ideal of style. James Huneker tells us that he dreamed of "long sweeping phrases, drumming with melody, cadences like the humming of slow uplifting walls of water tumbling on sullen strands." Do not permit yourself to entertain such an idea; it is not within the province of the technical writer, and will lead only to insincerity. Sincerity is the keynote to good writing. Those "lines of chiseled beauty" will come if you attend to the fundamentals and abstain from rhapsody. Anything like a personal or distinctive style cannot be acquired until you have trained yourself to control the gift of expression.

This advice on 'style' may seem premature; it may be like some other "road-maps to Parnassus that are useful only after you have got half-way up"; but I repeat: be natural; be yourself; shun artifice; avoid affectation; say frankly what you know or what you have observed; use only words the meaning of which you know; avoid purple patches and rhetorical confectionery. Group the com-

*Another chapter from the forthcoming book on 'Technical Writing', to be published by John Wiley & Sons, New York.

†"The word 'style' is derived from the instrument (stilus) of metal, wood, or ivory, by means of which, in classic times, letters and words were imprinted on waxen tablets. By the transition of thought known as metonymy the word has been transferred from the object which makes the impression to the sentences which are impressed by it, and a mechanical observation has become an intellectual conception." Gosse. 'Encyclopedia Britannica.'

position about the central idea. Be satisfied with short sentences until you have gained the experience that enables you to swing the longer ones dexterously. As you gain experience, vary the length of your sentences; the crisp sentence is a relief; the long and resonant period is delightful. Make the thought consecutive and place the sentences in such order that the succession of ideas leads naturally to a definite conclusion.

Not all engineers are graduates of a university, and many of those who have been so fortunate as to receive a liberal education are not well trained in the use of their own language; they have not had such a training as is founded upon a knowledge of the languages of antiquity, supplemented by careful reading of the English classics. To appreciate good writing keenly is a stimulus to developing one's own style. Such preparation is valuable, but it is not essential to the ordinary technical writer, provided he makes the most of his schooling and tries sincerely to avail himself of the means of expression at his command. University education rarely succeeds in producing men that write succinctly; intelligence and care—which is the supreme mark of intelligence—can accomplish great things.

Two examples will illustrate my argument. Several years ago I had to edit a long and detailed description of a metallurgical device and the operation of it. The article was eminently practical and businesslike. The subject did not permit any literary pose, yet the article evidently was the work of a capable craftsman. I found that it needed scarcely any editing, and when it was published I referred gratefully to the excellence of the writing. Happening to discuss the incident with a friend, I was asked by him to guess for what occupation the writer had been trained, and I said: "The ministry." This guess happened to be right, for the writer had been to Oxford and was intended for the Church before he wandered into a cyanide mill. The article bore the marks of the writer's training; a quiet command of English and a masterful use of it, making a difficult bit of technical exposition as clear and interesting as the subject permitted; and since "the home of lost causes" is not my *alma mater,* I may be permitted to acknowledge the value of Oxonian English in the literature of science.

My other example differs less than may appear at first sight. I have in mind an article describing mining conditions in a Central American republic. Such descriptions are usually made as verbally florid as the vegetation of the tropics and as involved as the jungle itself; at best, it is customary to bespatter them with unnecessary Spanish words and to deal in gorgeous generalities befitting the unlimited mineral resources of an inaccessible region. From these common faults this article was free. The sentences were short and to the point. The statements conveyed information without exaggeration. The writer kept what he knew at first hand separate from what he had merely been told; he gave just the information for which the average intelligent reader would ask, and a touch of humor was not lacking in his references to the queer things that happen on a Central American frontier. It was like the sensible talk of an intelligent traveler who has kept his eyes open and his notebook handy. The writer had not received a special training in the language of his own country nor in that of another; as a graduate from a technical college in Michigan he had acquired rather more of contempt than of love for the use of proper words in proper places, and yet, by dint of native intelligence and the desire to do his task well—the true professional spirit—he had succeeded in preparing an article that in its way was as good as that of the Oxford man. Both men were unaffected, both kept in mind the purpose of their writing, and both knew what they were talking about. The moral is that bad writing is due to insincerity, carelessness, or ignorance.

In the matter of the relative pronouns, as in that of preposition-verbs and hyphens—indeed, in almost everything concerning which I have endeavored to instruct you—you will find examples—even authority—to the contrary. Writing is a flexible instrument of expression, and the same thing can be said in many ways. The great art is to write the thing in the way that makes it most easily understood by the reader—the particular reader or the class of readers for whom it is intended. In order to learn, we must, of course, look backward for precedents and for critical judgments, but we should also occasionally turn and look forward, and in that forward looking we should keep our eyes on the purpose of our work. Whether one great writer fail to distinguish between relative pronouns or another use preposition-verbs like a German, does not matter greatly unless it hinder us in writing clearly on technical subjects. Amid the distortions of English and the uncertainties of rhetorical doctrine we shall not cry despairingly "Whither are we drifting?" Rather let us ask hopefully "Whither shall we steer?" The answer is prompt: "Out of the fog, into the sunshine of clear plain English."

Technical writing rarely conforms to the higher requirements of literature, largely because it is difficult to persuade technicians to conform to the lower requirements of plain scientific statement. George M. Wood, the editor of the U. S. Geological Survey's publications, confesses that "the purist or stylist would not be satisfied with the work done. The split infinitive may remain, unless it is very awkwardly split; the doubtful singular or plural may go unchallenged—whether three feet of sandstone *are* seen or *is* seen makes no difference to the editor so long as the verb is everywhere seen in the same number in the same paper; the restrictive 'which' that might be 'that' may go to print unless it conveys or suggests a wrong idea; 'whose' may be used for either persons or things without editorial protest, if not with commendation. Whether something 'had better' or 'would better' be done; whether work was 'commenced' or 'begun'; whether the indicative should be used where a writer of the old school would prefer the subjunctive are questions that consume none of the time of the editors. Great latitude of expression and of style must be allowed, and the individuality of the author must be preserved—unless his individuality should consist

principally in the repetition of faults of the kinds here described."

In the course of these lectures I have quoted many examples of bad writing. You will have noticed that most of the faults criticized are due to carelessness rather than ignorance. Thoughtlessness is fatal in matters that demand thought. Slovenly writing is the result of slovenly thinking, for "slovenly habits of expression corrode the very substance of thought."* It behooves us to remember that language in relation to ideas is a solvent, the purity and clearness of which affects the matter in solution. Whewell, in the 'Philosophy of the Inductive Sciences', has expressed this view with noble eloquence. "Language", he said, "is often called an instrument of thought, but it is also the nutriment of thought; or rather it is the atmosphere in which thought lives; a medium essential to the activity of our speculative powers, although invisible and imperceptible in its operation, and an element modifying, by its qualities and changes, the growth and complexion of the faculties which it feeds."

In considering this phase of the subject there comes to mind a suggestion that takes us far beyond the confines of the matter under discussion. Man's power of speech appears to divide him from all other living things; at the same time the imperfection of it weighs him down continually with the sense of an essential frailty. To be able to express oneself perfectly would be divine; to be unable to make oneself completely understood is human. In 'Man's Place in Nature' Huxley points out that the endowment of intelligible speech separates man from the brutes most nearly resembling him, the anthropoid apes, to whom he is otherwise akin in substance and in structure. This endowment of speech and the art of recording himself in writing enable man to transmit the experience that in other animals is lost with the individual life; they have enabled him to organize his knowledge and to hand it down to his descendants, first by word of mouth and then by written words. If the experience thus recorded were properly used, man's advancement in knowledge and in conduct would allow him to emphasize, much more than at present, his superiority over the dumb animals. Considered thus, language is a factor in the evolution of the race and an instrument that works for ethical progress—it is a gift to be cherished as the ladder by which man has climbed from his bestial origin and by which he may ascend to a loftier destiny, in which, ceasing to stammer in accents that are but the halting expression of swift thought, he shall unfold his mind in the fullness of speech, and, neither withholding what he wants to say nor saying what he wants to withhold, shall be linked to his fellows by a perfect communion of ideas.

In South Wales zinc-dust has recently been manufactured from metallic scrap, forming a product containing about 95% of active zinc, compared with approximately 85% for the by-product from the retort process.

*Allbutt.

Mining in Oregon

The bullion receipts from Oregon at the mint, smelters, and refineries at San Francisco show a falling off of $221,000 in gold and 5443 oz. of silver for the first six months of 1919 as compared with the corresponding period of 1918, according to Charles G. Yale of the U. S. Geological Survey. Although the U. S. Assay Offices at Boise and Seattle, and smelters at other points receive considerable gold from Oregon, the receipts at San Francisco indicate the general condition of the mining industry there. The reduction in output in Oregon is similar to that in other Western States, where high costs and scarcity of labor have affected adversely the metal-mining industry by closing down some mines and curtailing the operations of others. The statistics of the year 1918 for Oregon show a total reduction in value of the output of all metals of more than a quarter of a million dollars compared with 1917, which was, perhaps, less than might have been expected in view of the prevailing conditions in the mining industry. The gold dredges alone, which produce 78% of the total placer gold and 39% of the total gold, show a combined reduction in the output of gold of more than $250,000. The largest three quartz mines produced $77,000, and the largest hydraulic mines produced $10,000 less than in 1917. The principal copper mine in the State, however, materially increased the value of its output, and fully one-third more mines reported production than in 1917. Most of these added mines were small ones, operating temporarily, and mainly in camps where mining had been carried on for years. Some old dumps were utilized and more or less sniping and desultory placer mining was carried on in the gulches, ravines, and small streams in many mining regions.

The most productive copper mines are the Homestead Iron Dyke, in Baker county, and the Queen of Bronze, in Josephine county. There are four smaller copper producers in Baker county and three more in Josephine county. Small quantities of lead are produced in Baker, Jackson, and Lane counties. No new large mining operations have been started and brought to the point of production in Oregon within the last year and a half, except perhaps, the Oregon Dredge Co., in Grant county, which began operations late in 1917 and still continues. The Continental Mining Co., 23 miles from Sumpter, has put up a 20-ton flotation plant to treat high-grade gold-silver ore.

Owing to the high prices of machinery, labor, and mine supplies, little activity is being shown except at the established productive properties. With an appropriation of $50,000 by the Legislature, the Oregon Bureau of Mines is again at work after a period of inactivity in field work and publication during the War. Work in southern and western Oregon is now being done by the Bureau; work in the eastern part of the State is done in co-operation with the U. S. Geological Survey. The results of the work will be published in bulletins of the Oregon Bureau of Mines.

Flotation in Stages

By WILL H. COGHILL

*Early workers regarded flotation as a process of ore concentration that could be applied to any sulphide, however finely ground, but limitations have since been encountered. The grinding-and-flotation circuit is now receiving more serious attention. Already the limitation upon the degree of fine grinding has been admitted in technical literature by writers who have indicated the importance of stage-grinding to avoid excessive losses in the finest material.

Grinding in stages, as commonly used in flotation, is identical with that adopted in cyanide practice where the grinding unit consists of a mill in closed circuit with a classifier. Stage flotation is new to me and I present this paper in order to draw expressions from others who are interested in this subject.

Much has been said about the desirability of grinding to such a degree that the last grains of the economic minerals are unlocked from the gangue. In flotation such a procedure in grinding is likely to change only the nature of the loss. If the ore be of such a nature that it requires grinding through, say, a 120-mesh screen in order to avoid loss of locked grains, and if the sulphides finer than, say, a hypothetical 800-mesh are lost, the worker finds himself within embarrassingly narrow limits. In crushing through 120-mesh, to avoid loss in locked grains, many of the free and floatable mineral grains of, say, 60-mesh are so unnecessarily finely ground that a part of them is irrecoverable. This condition may be combatted effectively by stage flotation.

Stage flotation is repeated flotation where the rougher-underflow is classified and re-ground between successive flotation stages. It embodies adequate classification in which the ordinary closed-circuit stage-grinding may be a part.

In November 1918, assisted by J. P. Bonardi of the Golden station of the U. S. Bureau of Mines, I found evidence of the advantage of stage flotation at the molybdenum mill of the Primos Exploration Co., at Empire, Colorado, and the flow-sheet was accordingly modified. As a result of this change, and as a result of a change of oils, the recovery was increased approximately from 60 to 80% in November and to 83% in December. The screen analysis of the tailing that left the mill was not intentionally altered, but the diminished grinding that preceded flotation permitted the recovery of large floatable grains, which would have been subjected to excessive grinding in the former system.

After changing to stage flotation, as stated above, there remained a troublesome condition that could not be removed without a complete re-modeling at the head of the mill. A sample of the feed to the Marcy mill indicated that only 4.6% passed a 40-mesh sieve, but it contained 11% of the molybdenum content of the ore. This fine material, if practicable, should have been sent direct to the flotation cells but the system as installed required subjecting it to excessive grinding in the presence of 3-in. material in the grinding-mill. The loss of over-ground molybdenite therefore continued higher than if this preliminary separation had been made.

Stage flotation linked with appropriate grinding and precisely adapted classification will come more and more to the fore. It is a common occurrence to find the grade of the tailing increasing persistently with the grade of the feed. I believe that from a metallurgical standpoint this persistent increase in the tailing may be practically removed and that from a commercial standpoint much may be accomplished.

I have been inclined to the opinion that any sulphide can be ground so fine that it is not floatable. Molybdenite was taken as a striking example, though it was believed that its refractory nature would be exaggerated or minimized according to the type of the flotation machine, or to other variables. What I have proved is that an amenable molybdenite ore may be made refractory by excessive grinding; others have noted the difficulty arising from excessive fineness of the charge.

Stage flotation and better classification should be considered where the loss in tailing is segregated in the excessively ground material.

Two possible objections to stage flotation may be mentioned. First, floatable locked grains by entering the concentrate reduce its grade. Second, the re-ground 'sand' returned to the rougher reduces the capacity of that machine for virgin ore in proportion to the amount of sand returned. On the other hand, stage flotation has the advantage of furnishing a coarser concentrate to the smelter.

*Published by permission of the Director of the U. S. Bureau of Mines. The author is metallurgist to the Bureau.

THE OPERATIONS of prospectors in the neighborhood of Mapimi, in the State of Durango, have led conclusively to the belief in Mexican government circles that there exist large and important oil deposits in that vicinity. Already on the basis of these explorations several claims have been filed in the Department of Petroleum of the Secretariat of Industry, Commerce and Labor, and the concessions have been granted. The action of the Government in conceding titles is in accordance with the prevailing laws which allow the conferring of titles to lands in vicinities which have not yet been opened up for exploitation. Further concessions for new wells will not be granted in regions where petroleum is now produced, pending the enactment of the proposed petroleum laws which are now being considered by the National Congress. The new oil region is adjacent to the important mining sections of Velardeña and Pedriceña, within easy reach of Parral and Torreon, and there is good railway connection with Monterrey and in the industrial region thereabouts. It is understood that the concessionaries have already taken the first steps toward obtaining necessary drilling machinery, and it is expected that active operations will soon be in progress.

Mining at Braden

By FRANK CAMERON

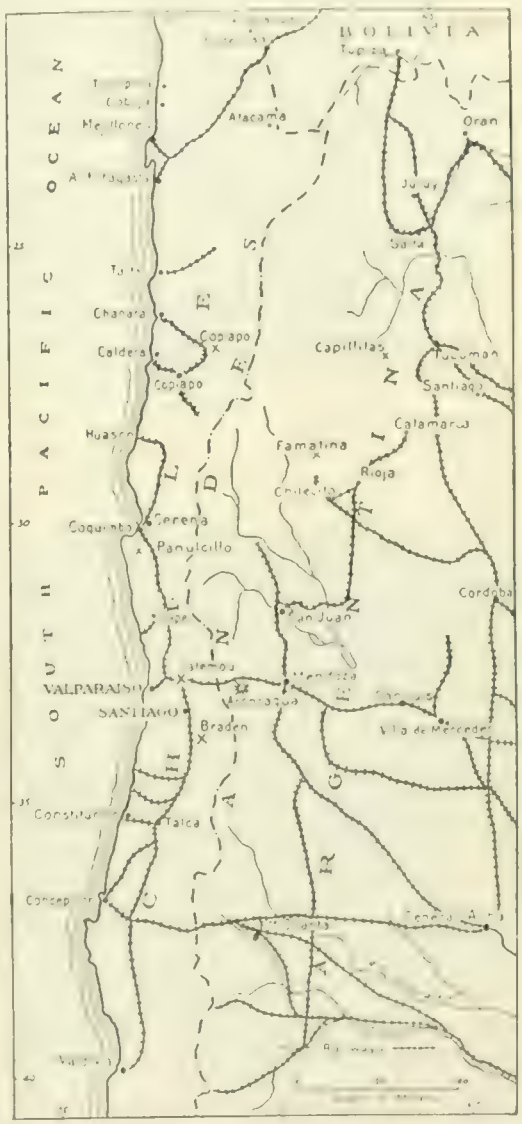
Introduction. Within the next few months a complete article will be published dealing not only with all the different methods of mining used in the various mines of the Braden Copper Co., but also describing the mountainous environment of the mine, its early history, the Chilean peon as a miner, the system of hiring and firing, the cost system, the welfare work for employees, and many other interesting features. Anticipating this publication, I shall only attempt to make a few remarks on the new method of shrinkage stoping, as employed at the Teniente mine.

Early History. The tradition goes that the Teniente mine dates back into the 18th century, when a Spanish lieutenant, who was a fugitive from justice, escaped to the snow-crowned Andes in eastern Chile, where he camped at what afterward became known as the Mineral Teniente. This man is said to have discovered a vein of high-grade ore, and from the proceeds acquired by selling certain shipments of ore, he paid a fine to the authorities, who then freed him from further difficulties with the colonial government. Be this as it may, the first official records date from 1819, when the working of the mine was undertaken by Don Juan de Dios Correa, Conde de la Conquista, and owner of the immense hacienda stretching from the coast range of the Chilean Andes to the Argentine boundary, within the limits of which the mines are situated. Don Juan de Dios exploited the mine until the early 'seventies of the past century, transporting the ore on muleback to the coast for exportation.

Partners were taken into the enterprise and one of them, Don Frederico Gana, a graduate of Freiberg, became manager. He drove what is known as the No. 1 adit and also sunk about 100 metres of shaft No. 1. Owing to the heavy snow-fall, all work was suspended during the winter, beyond keeping the shaft unwatered. According to one version, the mine-boss and the miners, during one of the winters, stole practically all the tools and equipment that could be carried off, so that in the following spring the owners found the shaft full of water. Whatever may have been the cause of the shaft filling with water, money was then required to get the mine into a state of production. The money not being forthcoming, the mine was abandoned, and the taxes left unpaid.

In 1897 Don Enrique Concha y Toro sent a prospector to the district, and after taking up claims to cover some of the most promising outcrops, including the old Teniente mine, he proceeded to sort high-grade ore from the old stopes, and sell it. At this juncture a lawsuit ensued between Don Enrique and Don Carlos Irarrazaval, who had married into the Correa family and was protecting their estate. When their difficulties were settled, Don Enrique received a third interest in the Teniente mine, together with the sole proprietorship of all the other mining claims that he had taken up there.

The Correa heirs were not inclined to invest any money



MAP OF PART OF SOUTH AMERICA, SHOWING THE POSITION OF BRADEN

in the property, and as Senor Concha y Toro did not care to open up a mine in which he only had a third interest, he began development work on some of his other claims, most of which was done on the so-called Fortuna mine. Sr. Concha y Toro was looking for high-grade copper ore and upon finding ore only running about 4% copper

and well disseminated in the country-rock, which meant concentration, he became somewhat bewildered as to what should be his next move. He sought the advice of a noted Italian mining engineer by the name of Don Marco Chiapponi, who recommended the construction of a concentrating plant. As this not only meant the construction of the concentrator but also a wagon-road, power-plant, and other equipment, Sr. Concha y Toro decided it was more money than he wanted to invest in a low-grade mine and entrusted Chiapponi with the sale of the property.

Chiapponi sent about 25 tons of the ore to Europe to be tested as a concentrating ore; and as these tests proved successful, the business was submitted to mining capitalists in France and England. Several foreign engineers were sent to inspect the property, but apparently they did not grasp the magnitude of the orebody and they reported adversely on the mine. About two years later, Sr. Chiapponi consulted William Braden, who, after a careful examination of the property, became favorably impressed with the project. Mr. Braden then interested his friend E. W. Nash, since deceased, but then president of the American Smelting & Refining Co., in the organization of the Braden Copper Co. for the exploitation of the property with a cash capital of 625,000 dollars. With this money a small 250-ton concentrating mill was built, also a wagon-road from Graneros, the nearest point on the State railroad to the mine; three aerial trams were constructed; a hydro-electric plant of approximately 100 hp. was added; living quarters at the mine and mill were provided; and the opening up of the mine was started. It reflects great credit on William Braden and his staff for completing this work within the limits of the estimated cost, in view of the fact that this was the first undertaking of its kind in the Chilean Andes, where the heavy snows of the winter are apt to shut-down construction work for weeks at a time.

The mill started to work in June 1906. The opening up of the mine was commenced, most of the ore coming from some small high-grade pockets in the vicinity of shaft No. 1 or in the so-called fumarole country. From 1906 to 1913 very little was done at the Teniente mine, as the Fortuna mine had become a producer and could always keep the bins full of ore. Most of the work at the mill and smelter was of an experimental nature and very seldom was the mine called upon to produce over 2000 tons per day. As the Fortuna mine could produce all the ore necessary and as money was rather scarce for such low-grade deposits, not much work was done in developing the Teniente deposit. Generally during the summer some 50 or 100 men would be put to work in the Teniente No. 1 adit, but as soon as the first signs of winter appeared, these men were transferred back to the other workings. It is quite a well-known fact that certain engineers employed by the New York office reported unfavorably on doing any development work whatever on the Teniente mine, as they stated that surface indications and all other information such as can be gathered from a visit to the deposit proved to them conclusively that although there was a large deposit of mineralized rock, still it never would be mined as ore, as it assayed not over 0.5% copper. The local officials of the mine, Robert Marsh, Jr., Edwin S. Berry, and H. R. Graham, submitted equally as strong an argument that there was a high-grade deposit of, say, 2% copper; but they were unable to drive their point home, until finally they decided to develop the mine with their own capital in return for 10 cents per ton on all ore so developed. This proposal was taken up by the general manager and his respective immediate superiors, and the contract was practically ready for signature when ill fate interfered and there was a change of management. It is needless to relate the remarks of the local officials, and how they thought another chance to play the rôle of Wallingford had slipped from them.

From 1913 to 1915 the work at the Teniente mine was pushed with considerably more speed, completing the driving of the Teniente No. 1 adit completely around the crater to connect with Fortuna No. 2 adit. Some work was started on Teniente C adit from the surface, during the latter part of this period and shaft No. 2 was practically completed except for the timbering.

It was not until the latter part of 1915, when the Braden Copper Co. was taken over by the Kennecott Copper Co., that the opening up of the Teniente mine to such an extent as to become a producer was found necessary in order to supply the ever-increasing demands of the mill and smelter, which by this time had grown far beyond the capacity of the mine, as regards supplying the requisite tonnage. Immediately some 200 to 300 men were put to work and level after level was opened up from Teniente No. 1 to Teniente J, or eleven in all. It was the desire of the management to reach the uppermost levels, where caving methods could be employed without the danger of making any appreciable admixture of waste with the ore; but until this point was reached it was necessary to produce from 1500 to 2000 tons of ore daily, which ore must come from shrinkage stoping.

Certain sections on Teniente 1, C, E, and F levels were selected for stoping-areas, the general custom being to run two to four regular 7-metre (23 ft.) stopes with the regular 5-metre (16.4 ft.) pillars and then leave a block of ground about 100 m. (328 ft.) thick before starting another series of stopes. In this way absolutely no harm was done to future operations and yet a considerable daily tonnage was obtained until the caving sections could be opened up and prepared for caving.

Present System of Mining. Some four years ago, at which time the dimensions of the orebody were not definitely known, it was decided to develop the true limits of the orebody by means of cross-cuts driven from a series of hanging-wall drifts placed 50 m. (164 ft.) vertically one above the other, this 50-m. interval constituting the vertical distance between levels. These drifts followed more or less the contact of the Teniente breccia and the tuff, and were driven in a series of tangents that were connected by short and rather high-degree

SEWELL ON A WINTER'S NIGHT

A CHILEAN LOADING A ONE-TON CAR WITH ORE

A CHILEAN MINER IN A 45° RAISE

PANORAMIC VIEW OF SEWELL

FOUR ORE-PASSES EMPTYING INTO A CENTRAL DUMP

SMELTER AND NODULIZING PLANTS IN THE LEFT FOREGROUND AND CONCENTRATOR TO THE RIGHT UPHILL

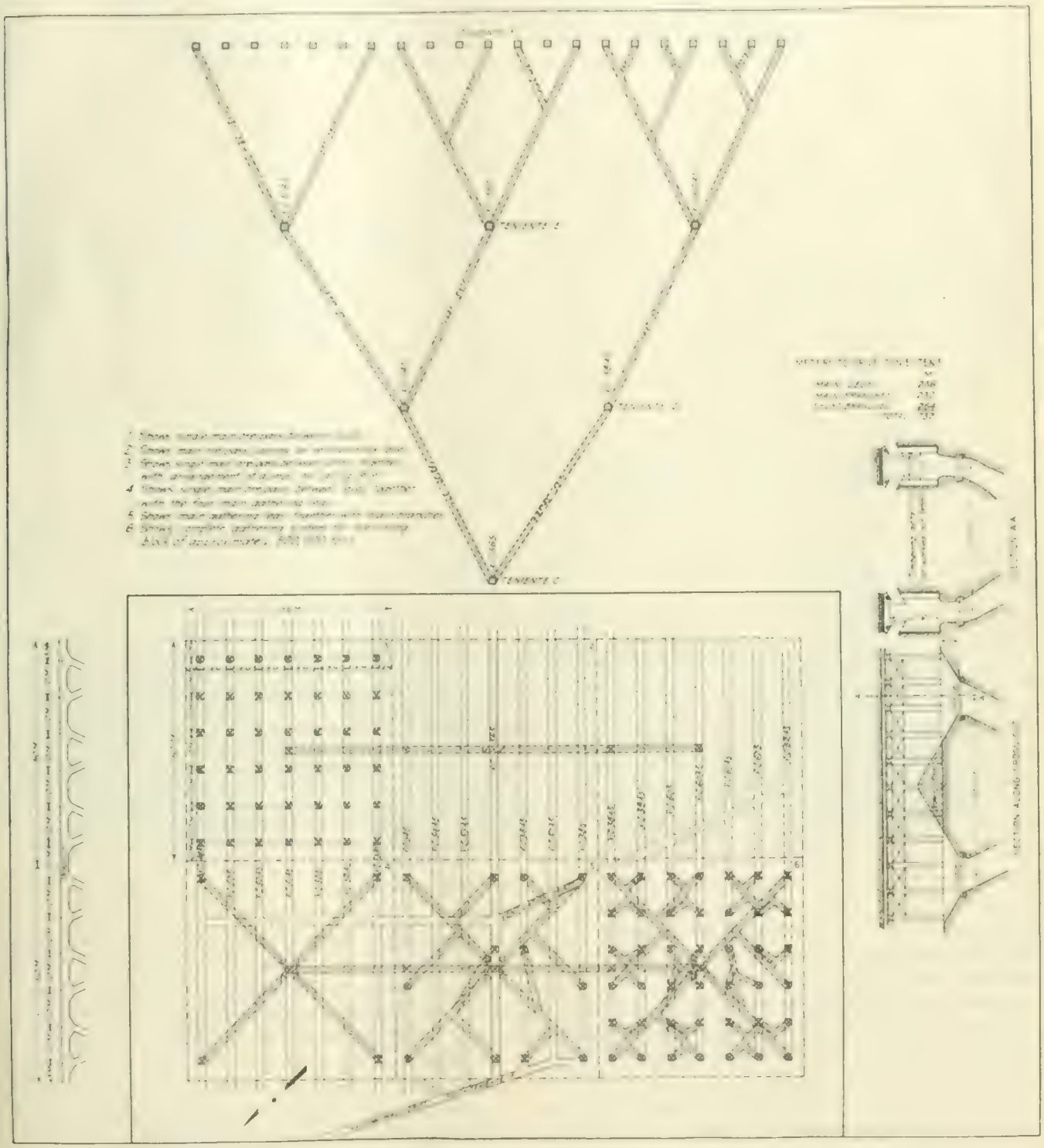
CHILEANS BLOCKING A SET OF TIMBERS

A SNOW SCENE IN SEPTEMBER 1918, SHOWING THE HOUSES OF THE AMERICAN TOWN-SITE ALMOST SUBMERGED

THE SNOW-SLIDE OF 1914 IN WHICH SEVERAL LIVES WERE LOST. RESCUE PARTIES ARE SEEN DIGGING FOR THE VICTIMS

curves, in order to follow the geology of the crater with as much straight drift as possible.

Upon ascertaining the true width of the orebody, it was decided to drive a barrier pillar drift every 100 m. (328 ft.) in order to acquire speed in opening up and to keep all development work in ore. These drifts are numbered from hanging to foot-wall and are parallel to the longitudinal axis of the orebody. The caving sections of the respective levels having been reached by these drifts, the cross-cuts are marked off immediately by the engineering department and they are started both toward hanging and foot-wall. With the completing of a cross-cut, then, the stope-raises, which are 20 ft. centre to centre, are marked off and started. The first round is generally shot onto the floor of the cross-cut, whereupon



PLAN AND SECTIONS OF THE PROPOSED GATHERING SYSTEM FOR THE TENIENTE OREBODY

the standard 10 by 10-in. pine sets are placed in position and chutes are built in. All sets are at 5-ft. centres and are 8 ft. high by 7 ft. wide. These dimensions vary a few inches with the different sizes of timber. After completing the first two stope-raises, which are driven at 45°

and for 4.50 m. (14.8 ft.), the connecting operations are started. These are nothing more than the joining of the various stope raises by means of a 7 by 7-ft. cross-cut driven parallel to the main cross-cut but along the centre-line of the stope. The right-hand side-line of the stope is practically over the left-hand side-line of the cross-cut. When 'connecting-up' operations are half completed, the actual shrinkage-stoping operations are started. The first few rounds are designed to open up the stope to full width. It has been proved at this mine that the above-described method of connecting-up is not only the fastest but also the cheapest in getting a stope to the producing stage; the great advantage being the definitely determined side-walls from which to enlarge so as to ascertain the true side-walls of the stope, because this affords an ideal opportunity for the proper spacing of holes from the very beginning of each and every stope. To a great extent this one feature is highly responsible for the increased breakage from about 40 tons per machine-man shift to between 60 and 70 tons per machine-man shift, this last figure often running as high as 85 tons. The stopes are provided with from 4 to 6 machine-men per shift and the stope is rushed to a point 7 m. (23 ft.) vertically below the floor of the next higher level. Most stopes are completed within six weeks, and 40% of the broken ore is recovered for immediate tonnage.

Method of Handling Ore. The greatest innovation introduced into the mining at the Teniente mine, as regards that at the Fortuna mine, has been in the handling of the ore. By means of an ore-pass gathering system, designed by H. R. Graham and his immediate associates, tramming the ore by the use of cars has entirely been dispensed with, except for a small tonnage coming from development headings. The orebody has been blocked out and ore-passes designed to gather certain sections, such as can be seen upon the accompanying section. The ore-passes are laid out in systems and are numbered like the barrier-pillars drifts. Each system comprises four main ore-passes, 14 legs, and 24 branches, making a total of 42 ore-passes, legs, and branches per system, or 732 m. (4401 ft.) in all. All main ore-passes are driven at 55° and are two metres square, whereas the legs and branches vary in slope from 55 to 60° and are driven 1.5 m. square. One system gathers seven cross-cuts for a width of 60 m. These ore-passes, legs, and branches break into the various cross-cuts at points 10 m. (32.8 ft.) centre to centre, one from the other. All dumps are built two metres wide and four metres long, so that the longest possible distance one chute could be away from a dump would be three metres (9.8 ft.). By a series of bottom-dump chutes for those passes that practically come over the various dumps, and by a series of incline chutes taken out of the side and back for those passes that are intermediate between dumps, the handling of the ore is controlled by a squad of *compuerteros*, or gate-tenders. All the branches feed into the various legs and all the legs feed into the four main ore-passes, which gather at one common dump on the succeeding level. From this point the ore is handled by a series of control-gates, spaced every 50 m. (164 ft.) apart or at more frequent intervals, provided the ground is of a highly fractured type, to the main haulage-level, where it is dumped into 20-ton cars and trammed by means of 25-ton D. C. electric motors directly to the coarse-ore bins. The advantages to be derived from this method of handling ore over that formerly employed, by tramming with one-ton cars, are: (1) greatly reduced amount of track, tins, etc., using none except for developing purposes, and using them over and over again; (2) no maintenance of track; (3) no cars except as needed for development work; (4) no maintenance of cars; (5) no car-men, which type of Chilean labor causes the most trouble and is rightly named the 'fly-by-night' element; (6) greater extraction with cheaper maintenance as regards timbering, as often several posts in the centre of cross-cuts are jackknifed before all the ore beyond them has been extracted. With this system it is only necessary to keep the cross-cut open sufficiently for a passage for the workmen; (7) weakening the orebody by the wear of the ore through the ore-passes, so as to cut down the height of the stopes on all subsequent levels after the first sections have been caved; (8) increased tonnage in driving ore-passes, legs, and branches in ore, which tonnage practically pays for the driving of them.

The only disadvantages are the danger in raising so many ore-passes and the delay due to certain systems being hung up on account of a plugged ore-pass. However, all these ore-passes are raised in short lifts and first-class ventilation is maintained through the driving of them; so that the first disadvantage is avoided. Owing to the great number of systems, any one system can be stopped for several hours without materially affecting the daily tonnage from the mine. While to date this system of handling ore has not been sufficiently tested to ascertain the true cost per ton of ore, still it has been conservatively estimated that at least a reduction of 5 cents per ton of ore can be made on the cost-sheets when this system is employed throughout the mine.

In closing this article, I wish to commend the company and local officials of Braden very highly for the way and manner in which they have conducted business in a foreign country. The laborers have been provided with better homes than previously enjoyed in the capital city, namely Santiago; their working hours have been shortened 50%, they now are enjoying the 53-hour week; the cost of living has been held down while wages have been advanced; schools have been provided for the native children and the married man given preference over the single man; all forms of amusement, such as motion-picture theatres, gymnasiums, club-houses, playgrounds, ball-parks, and tennis courts have been furnished by the company; first-class hospitals have been built and A 1 medical treatment offered to all employees at a minimum charge of one dollar per month; and yearly bonuses amounting to 10% of a man's yearly salary are given to each employee that has worked 300 days out of the possible 365 days of the year.

REVIEW OF MINING

ARIZONA

CONDITIONS AT DOUGLAS AND HUMBOLDT. MORENCI PLANTS TO BE RE-MODELED.

Douglas.—The Calumet & Arizona smelter here showed a slight increase in production in August over that in July, but this was said at the smelter to be more or less accidental, as no effort to speed production is being made at the present time. The one department now working at full capacity is the acid plant, which supplies the New Cornelia at Ajo with acid for use in its flotation process. The acid production, now at top notch, increased about 1000 tons during the month, the total made being approximately 6000 tons.

SMELTING PLANT OF THE CALUMET & ARIZONA MINING CO. AT DOUGLAS

Humboldt.—The Consolidated Arizona Smelting Co. of Humboldt authorized the following statement: "From the Blue Bell and De Soto mines of this company a total of 12,200 tons of ore was shipped to the Humboldt reduction works; our concentrator handled 8450 tons of material, while the smelter proper treated 7000 tons of new metal-bearing ores and concentrates during August. In that month we made shipments of 650,000 lb. of fine copper in bullion to Eastern refineries, the majority of which was derived from domestic ores."

Morenci.—It has been decided by the Phelps Dodge Corporation to build a new mill for the treatment of its Morenci ores. The exact location of the mill has not been decided, but two possible sites are under consideration. The concentrator will be constructed in 1000-ton units and will have an initial capacity of 2000 tons per day. It has been announced that a five-compartment shaft will be sunk while the mill is under construction. New hoisting and tramming equipment, electrically driven, also will be installed. A vigorous campaign of underground development will be started at once. The smelting plant also will either have to be extensively re-modeled or entirely re-built in order to introduce economies vital to the operation of the property on account of the decreasing grade of the ore. Under the present system it would be impossible to operate longer at a profit. In order to make the contemplated changes the company must expend between $2,500,000 and $3,000,000. The announcement was made that, as a preliminary to new construction, the property would close down all departments September 6. This meant, of course, rendering idle several thousand men, but construction work will be rushed and, so far as possible, old employees will be used so as to hold the force together until operations can be resumed. When the contemplated improvements have been completed it is expected that operations will be resumed with an increased force.

COLORADO

OPERATIONS AT CRIPPLE CREEK AND LEADVILLE.

Cripple Creek.—The highest grade of ore now being shipped from the Cripple Creek district is coming from the Index mine on the western slope of Gold hill, owned

by the El Paso Extension Corporation. The ground north of the shaft is under lease to the Beacon Mines Co. An orestreak under development from the 400-ft. level of the Index shaft is breaking five to eight feet wide and producing ore assaying 2 oz. for coarse in carload lots and 5 oz. for screenings. Denman and Searles, operating individual leases on the Jerry Johnson mine on Ironclad hill, are both mining a good grade of ore and shipping steadily to the Golden Cycle mill. The Forest Queen Mines Co. is making regular weekly shipments of ore assaying about $30 per ton. The Six Points mine of Stratton's Cripple Creek Mining & Development Co., under lease to C. A. Larson of Victor, is producing 50 to 60 tons weekly assaying about 1 oz. Gorman and associates, operating a sub-lease from Anderson and Benkelman on the Trail, are expected to make a good profit on the money expended in sinking the shaft an additional 100 ft. and cross-cutting to the vein. The work was performed in record time.

Work is progressing on the 1250-ft. level of the Blue Flag, to connect with the Moffat tunnel and then through to the War Eagle consolidated property to the north. The drift is following a vein, but assays do not yet indicate profitable ore. Dividends were paid on September 10 by the Cresson Consolidated company and the Golden Cycle Mining & Reduction Co. at the usual rates of 10 and 3c., respectively. The Cresson dividend amounted to $122,000 and the Golden Cycle to $45,000. The Portland and Vindicator companies are expected to declare the regular quarterly dividends this month.

LEADVILLE.—Ore assaying from 3 to 7 oz. gold and 100 oz. silver has been cut by the heading of an old tunnel on the property of the Fidelity Mining Co., in the vicinity of Twin Lakes, on Bull hill, a spur of Mount Elbert. The property is controlled by Charles J. Fox of Philadelphia. The vein is reported to be four or five feet wide and carries two streaks of high-grade ore from six to ten inches wide. The Harvey brothers of Denver and their associates are operating the Bowman and Dewar property in the Red Mountain district, 13 miles above Twin Lakes. They are saving and sacking high-grade silver ore. The same interests are also operating the Collins property, in Sayre gulch. A complex ore containing gold, silver, and lead is being mined and the outlook for a persistent producer is promising. The property is owned by George B. Collins of Leadville. The Mock and Hartman property in the Red Mountain district is active and the showing is excellent. A network of veins carrying visible gold has been opened by surface trenching and a tunnel is now planned to tap the veins at depth.

A GLIMPSE OF WARD, COLORADO

George Nichols and associates are operating the Sailor Boy mine in Lincoln gulch, on the Pitkin County slope, and are saving high-grade silver ore. The Ruby property in the same district, under lease to Koby and associates of Aspen, is under development and high-grade silver ore is being mined and shipped. This property paid with silver selling at 50c. per ounce, but has long been idle. The Miller Mining Co. has leased the mill, tramway, and upper workings of the Miller property to the Mount Champion Mining Co. The tunnel is to drive through the Mt. Champion holdings to cross-cut the ground 200 ft. below the old workings. The mill will be enlarged to a capacity of 200 tons per day, and with the large tonnage of low-grade milling ore in the Mt. Champion group made available it is expected that it can be kept in operation for an indefinite period. At a meeting of the Prospect

Tunnel Co. held here last week it was determined to resume operations. The Down Town Mines Co. is hoisting 400 tons of ore daily operating with three shifts. The water situation is held under control by the huge pumps at the Penrose shaft.

NEVADA

GOLDFIELD AND DIVIDE.—THE STRIKE SITUATION AT TONOPAH.

GOLDFIELD.—A. H. Lawry, superintendent for the Goldfield Consolidated Mines Co., has succeeded A. I. D'Arcy, resigned, as manager for the Wingfield companies at Goldfield. The Wingfield companies now operating are the Atlanta, Kewanas, Blue Bull, and Merger. William Sharp, assistant to Mr. D'Arcy, who had been in direct charge of these mines, will enter the employ of the Goldfield Development Co., according to present plans.

LOOKING FOR SOMETHING TO LOCATE

On September 11, A. I. D'Arcy, vice-president and general manager for the Goldfield Development Co., left for New York to consult with L. E. Whicher and associates on plans for financing the enlarging of the mill to 2000 tons daily capacity. Working with a small force, the company has completed a 500-ton bin at the main shaft and a 900-ft. spur track from the company railroad. Heavy mill machinery, such as thickeners, classifiers, and filters, are being shipped to the mill from the Consolidated plant at Aurora, which is being dismantled. A pipe-line is being laid from the shaft of the Silver Pick company to the main mill water tanks on Columbia mountain to provide an ample supply for the 2000-ton plant. Two electric storage battery locomotives, which will make a total of four, have been ordered for use underground and new electric generators for use with these have been ordered to replace the storage plant formerly used by the Consolidated. The Consolidated plant, which was designed to operate one 150-hp. motor for 8 hours, is considered obsolete. The cross-cut to the Florence is nearing completion and the next important work to be undertaken is the repair of the main shaft, which is in poorer condition than was thought for a considerable distance above the 380-ft. or main haulage level. The pumps at the Grizzly Bear shaft have been overhauled and are now in good condition. Eighteen inches of ore estimated to contain 500 oz. of gold per ton is exposed in the back of a stope in the Florence Divide lease on the Florence. The shoot was opened in stoping low-grade ore 8 ft. into the hanging wall of the vein from which a shipment estimated to have been worth over $90,000 was made. When first found it was less than 1 in. wide and reached the present width within a distance of 18 ft. Engineers who saw the vein from which $90,000 was shipped and who have examined the more recent discovery are of the opinion that the latter will prove at least equally persistent. The rich ore is being broken for the width of the vein and stored. The last four carloads of lower-grade ore shipped from the lease have assayed $30, $60, $62, and $84 per ton, indicating the approach to the rich vein. All lease blocks in the Florence have been taken with exception of two.

The east drift on the 365-ft. level of the Great Bend is 425 ft. long and, according to J. K. Turner, superintendent, ore of shipping grade should be opened within an additional 100 ft., as within this distance the drift will be well under the stopes on the 236-ft. level. Drifts and raises on and above the 160-ft. level, in the oxidized zone, have resulted in ore of highly erratic grade being exposed. One drift was driven 275 ft. in the vein 60 ft. above the level. During a period of over six months the ore production, entirely from above the 160-ft. level, has amounted to 85 dry tons assaying $21.48, from which the net return was $1103. During this period 655 ft. of development work was performed in all parts of the mine. In a cross-cut driven east from the main south drift on the 910-ft. level the Spearhead has exposed in the shale a vein of quartz 18 in. wide assaying from $30 to $35. The seam is 22 ft. long and is considered by R. S. Wilbur, foreman of the mine, to be the most persistent orebody opened on this level. Raising in the ore has been started.

DIVIDE.—The entire face of a drift being driven from the bottom of a 60-ft. shaft on the West Divide is in silver ore of shipping grade and indications are that the company has a highly promising prospect. The vein is from three to six feet wide and has been traced on the surface for 2000 ft. A shoot three feet wide in the back of the drift and narrowing to 22 in. in the bottom assays from 75 to 100 oz., with material on each side assaying 50 oz. Assays of 37 oz. are obtained for from 6 to 8 in. into the walls of the vein. A 5-ft. width averages 77 oz. as broken. The drift has been driven 10 ft. in the shoot, starting with from 18 in. to 2 ft. of ore assaying over 90 oz. Over a carload of ore is broken or in sight. L. L. Patrick of Goldfield is manager for the company.

Tonopah.—After having taken a prominent part in the settlement of the Ely strike and in averting a walk out at the Virginia City mines, Governor Boyle is in Tonopah attempting to settle the strike that has had the Tonopah and Divide districts tied up since August 17. On the night of September 8, speaking before 5000 people in the Tonopah ball park, the governor made it plain to the workers that the operators would not deal further with the present workers' committee, which is said to be controlled by the radical element. He said this committee was of no further use in conducting negotiations. The governor's speech was filled with caustic references to the I. W. W., which he said had "scabbed shamelessly on the job when the whole civilized world was on strike against an autocracy that threatened to destroy every democratic institution." He threatened to use force to compel a resumption of operations if both sides continued to stand pat. An I. W. W. element is responsible for the trouble, according to all reliable reports in Tonopah. It is said this element engineered the strike against the will of the conservative workers and that a settlement cannot be reached while the radicals remain in control. The best miners have left both districts in large numbers. Through fear of becoming involved in the trouble, the Goldfield Development company at Goldfield, 29 miles south, has practically suspended operations. This company was employing 125 men. At Ely and Virginia City the workers returned without wage increases and it is the opinion that this will also be the case in Tonopah and Divide, as the principal operators have stated that they are determined not to accede to the wage demands of the miners. The miners have appointed a new committee as suggested by the governor and, while the radical element is interfering with the work of this committee in attempting to reach a settlement, it is believed the governor has the situation well in hand and that the trouble will end within 10 days.

Tokop.—The Mount Vernon Mining & Milling Co., operating under bond and lease a large group of claims owned by the Le Champ-D'or French Gold Mining Co., Ltd., at Tokop, 30 miles south of Goldfield and 9 miles south-east of Hornsilver, is sinking a shaft to develop water for a mill. The Mount Vernon is a Nevada corporation. The Le Champ-D'or, a French company with offices in Paris and London, is also the owner of the Orleans at Hornsilver and is the former owner of the Silver King at that place. The claims at Tokop are reported to have produced from $20,000 to $25,000 worth of gold-silver ore of an average grade of from $15 to $25 per ton, with some shipments of ore assaying $50. The entire production was made by lessees from within 75 ft. of the surface, which is the maximum depth to which the claims have been opened. There are numerous tunnels and shafts, the work of lessees, but there has been no systematic development. It is estimated that over 10,000 tons of free-milling ore is in lease dumps and it is the plan of the Mount Vernon company to erect a small mill for the treatment of this while working to gain greater depth. A mill at Tokop treating custom ore, as the Mount Vernon plans to do, would have a large and rich field in the Tule region, the Slate range, Old Camp, near where the Nevada Empress is situated, and other districts.

Bonnie Clare.—The Clark interests are reported to be seriously considering the erection of a smelter at or near Bonnie Clare. The construction of such a plant has been rumored for many years, but on this occasion the report has passed the rumor stage and the feasibility of the plan is being investigated by engineers. Ore would be furnished from the deep levels of the Goldfield mines and from the lead-silver mines south of Beatty.

A RIVER SCENE IN THE YUKON

ALASKA AND YUKON

ESTIMATE OF GOLD PRODUCTION FOR THE SEASON.

Dawson.—It is estimated that the total gold output of the placer camps of the Yukon Territory and of Alaska will be $5,250,000 to the close of navigation in October.

To this may be added half a million dollars if the districts of Atlin, northern British Columbia, and of Nome, Alaskan coast, are included, each of these sections being given credit for a quarter of a million. Another half a million may be yielded by other scattered camps throughout the north so that it is possible that the aggregate will reach $6,250,000 for the year 1919. All northern camps are led by the Klondyke, with Dawson as the centre, its season production being placed at $2,000,000. Second place is taken by the Tanana Valley, as Fairbanks, Tolovana, and the Hot Springs are credited with $1,500,000 or more. On his return from a tour of the posts controlled by the Northern Commercial Co., Volney Richmond, the company's superintendent, estimates the season's placer gold yield as follows: Dawson, $2,000,000; Fairbanks, $800,000; Iditarod, $750,000; Tolovana, $700,000; Kuskokwim, $250,000; Circle, $225,000; Ruby, $125,000; Koyukuk, $100,000; Marshall, $75,000; Hot Springs, $60,000; Ophir, $50,000; Rampart, $25,000; Chandlar, $20,000.

BRITISH COLUMBIA

ALICE ARM AND NELSON.—GENERAL NEWS.

The northern mining camps of British Columbia have come prominently to the front in the last few years and now lead all other parts of the Province in the production of metalliferous minerals. In 1913 the Cassiar mining division, which covers the Atlin, Stikine-Liard, Skeena, Nass River, Portland Canal, and Queen Charlotte districts, produced minerals to the value of $65,772, while last year the value of the mineral production from that division totaled $9,178,441. Of course, the Granby company's Hidden Creek mines were mainly responsible for this increase, an increase which is made more remarkable by the fact that for four and a quarter out of the five years that it was taking place the country was at war and there was considerable difficulty in getting labor. The Anyox smelter was blown-in in March 1914, and up to the end of last year it had smelted 3,334,446 tons of ore and had produced in round numbers 142,047,400 lb. of copper, 1,333,700 oz. of silver, and 50,000 oz. of gold. Other parts of the division have done well, and considerable activity is being exhibited at both Alice Arm and Portland canal. Owing to the impossible state of the trails, ore cannot be hauled from the Salmon River mines except over the snow during the winter, and for that reason the returns from the Premier mine did not get into last year's report. This mine alone is said to have shipped during last winter some 500 tons of ore, averaging in the neighborhood of $350 per ton, and, from accounts that are being received from the district, the output during the coming winter will be so sensational that it will be likely to precipitate a rush to that part of the Province next spring.

ALICE ARM.—Considerable activity in mining is being shown at Alice Arm. R. Besner and associates have struck a 40-ft. face of ore, assaying 130 to 300 oz. per ton in silver, on the Climax claim. Rich silver ore has been developed in the North Star mine by James McAleenman and D. Zarilli. The Sweetwater claim, near the Dolly Varden, has been purchased by David J. Hancock, who recently purchased the group of claims owned by the United Metals Co. From the Joplin and Silver Star claims Mr. Hancock is turning out ore running 380 oz. silver, $13 gold per ton, and 65% lead. Nearly 200 tons of this material is sacked ready for shipment. The La Rose mine is taking out some rich silver ore. Two shipments have been made, one going to Trail and the other to Anyox. The Taylor Mining Co. will erect a 3000-ton ore-pocket on the wharf at Alice Arm. Since the Taylor company took over the Dolly Varden 150 tons of ore per day is being shipped.

On his return from a recent tour of northern British Columbia, in the course of which he visited Alice Arm, Anyox, and other mining centres, Dr. King, Minister of Public Works, stated that he noted a marked increase in mining activity and that a spirit of optimism was apparent which had been lacking in recent years. He inspected the Dolly Varden mines and railroad operating between tidewater at Alice Arm and the mines, a distance of 18 miles, construction of which was authorized by the Provincial Government. Dr. King states that it is the intention of the Taylor Engineering Co. to extend the road for four miles next year, thus affording transportation facilities to other properties now being developed and which are making excellent showings. There is promise of a large tonnage being offered the railroad and the management is anxious to handle as much as possible, not only that the mineral deposits of the country may be made to yield, but that the railroad may be made to pay running expenses. Shipments from the Dolly Varden are expected to continue as long as the weather permits. Under Majors Young and Davis, both mining men recently returned from overseas, splendid progress has been made at the mine. A steam compressor and a 2000-ft. aerial tramway are in operation and the whole property now is as fully equipped mechanically as the difficulty in obtaining machinery would permit. It was necessary to complete the railroad and the aerial tramway before opening the mine to any extent. Discussing conditions in the Alice Arm district, Mr. Taylor, manager of the Taylor Mining Co., which owns the Dolly Varden mine, said that more engineers and prospectors had gone into the country than during any five years preceding.

NELSON.—There is considerable activity at the Eureka mine, Eagle Creek. W. M. Myers, the superintendent, is surveying preparatory to the installation of a new aerial tramway from the upper terminal of the Granite-Poorman tramway to the lower adit of the Eureka workings, which will be about 3000 ft. in length. The Granite-Poorman mine tramway, running between the mill and Granite Siding, a distance of 3000 ft., is being dismantled and the material will be put in the new line. The tramway being removed was utilized originally to facilitate shipment to the smelter. The Granite mill is running steadily on two shifts, handling ore from the upper levels of the Eureka. A cross-cut is being driven on the latter

[illegible] which will give 450 ft. depth on the vein. There have been a number of visitors to the Eureka from Walla Walla, Washington, recently, among whom were Mr. and Mrs. C. E. Nye, the former being the president of the Inland Mining Co., which is responsible for the work outlined. Reports reaching Nelson are to the effect that work is proceeding on the Lucky Boy and the Security mines of the Erie district which, together with the Second Relief Property, suffered by fire on July 16. S. L. Myers, superintendent of the two former properties, is engaged in getting out timber for a new bunkhouse and for other buildings. In the meantime Mr. Myers is camping in the tunnel of the Lucky Boy.

Grand Forks.—The Consolidated Mining & Smelting Co. is installing three decrepitating furnaces and rotary kilns at the Rock Candy fluorspar mine near Lynch Creek. Since the completion of the concentrator at the property early this year experiments have been in progress as to the proper method of treatment, and it is said that A. A. Roberston, who is superintendent in charge, has met with success with the decrepitating process, something new for this Province. Generally speaking this consists of breaking the fluorspar by means of a decrepitating furnace and rotary kiln, crude oil being used as fuel. One unit of the process was first installed and the results being satisfactory it was decided to install three more. When these are operating it is expected that the plant will handle about 100 tons daily. The demand for fluorite is said to assure the continuous operation of the mine and plant.

MANITOBA

Copper Lake.—J. P. Gordon, owner of the gold property recently discovered at Copper Lake, Manitoba, which created much excitement in mining circles and attracted many gold seekers from the Northern Ontario camps, has arrived at Winnipeg, bringing samples and additional details of the find. The vein has now been exposed continuously for 900 ft. It is about 10 in. across on the surface and 18 in. wide at a depth of 6 ft. For some distance along the foot-wall a layer has been found 4 in. wide at the top and 6 in. at the bottom of the pit, from which specimens of exceptional richness were taken. Another property owned by Mr. Gordon in the same neighborhood consists of a large silicious sheer zone, averaging 20 ft. in width, which has been traced with fair continuity for two miles and is stated to give assays of $9 per ton. Mr. Gordon holds 14 claims covering these orebodies.

ONTARIO

STRIKE AT COBALT AND KIRKLAND LAKE SETTLED. PORCUPINE AND LARDER LAKE ACTIVE.

Cobalt.—The miners' strike, which has been in progress for about seven weeks, has been settled and the men are returning to work. At a mass meeting held on September 7 the men, after a heated discussion, decided to accept the terms offered by the mine managers. These comprised an increase of 50 cents per day in the base wage scale, the bonus to be on the price of silver over 80c. per oz. instead of 60c. as formerly. This ensures the men against the consequences of a heavy drop in the price of the metal. Provision is also made for a form of collective bargaining by committees chosen by the men independent of the union. The mine managers state that there will be no discrimination against strike leaders and that positions are open for all. It is stated that in most cases the mines are in good shape and that operations can be immediately resumed. The settlement also includes the men at Kirkland Lake, who have been out for nearly three months, but whether there will be a general resumption of work there remains to be seen, as by far the greater proportion of the miners have left the camp and many of the mine owners professed indifference regarding re-opening until they see an opportunity to reduce overhead expenses.

Porcupine.—The upward movement of Dome Extension stock combined with the character of the development work carried on by the Dome Mines at the Dome Extension, are believed to indicate the taking over of the latter property by the Dome under its option which expires in March next. It is noted that the work being done on the Extension is not merely exploratory but includes preparation for actual production. The terms on which the option is held are on a basis of 30 shares of Dome Extension for 1 share of Dome Mines, and the extensive buying of Dome Extension shares is taken as indicating that those having inside information as to the probable closing of the deal are taking this means of securing shares in the Dome at considerably below the market price. The McIntyre is developing an orebody on No. 5 vein at the 1100-ft. level over 800 ft. long and 30 ft. in width, the gold content of which runs higher than those of the ore now being milled, which yields about $11 per ton. The main shaft is now down 1400 ft. and stations are being cut at the 1250 and 1375-ft. levels where lateral work will shortly be started. The McIntyre mill is treating 40 tons per day of ore from the 100 and 200-ft. levels of the Plenaurum property. The Clifton, on which work was started only a few weeks ago, has a considerable quantity of ore blocked out.

Matachewan.—A second shaft is being sunk on the Otisse property of the Matachewan Gold Mines Co. at a distance of about 1000 ft. from the original workings and along the strike of ore deposition. Lateral operations are being conducted on the 170-ft. level from the first shaft. The company is stated to have acquired an adjacent property previously controlled by R. Norrington of the Allied Gold Mines. A. G. Burrows of the geological staff of the Ontario Bureau of Mines is making an examination of the Matachewan area.

Larder Lake.—There has lately been a marked revival of interest in this area, where more actual mining has been done in the past six months than during its previous history. For many years this district was under a cloud owing to the operations of unscrupulous promoters, who swindled many thousands of investors by

becoming undeveloped and probably worthless prospects, and many claims of the large number staked in the early days of the rush were allowed to lapse. The operations of the Associated Gold Fields, which is opening up large bodies of low grade ore on an extensive scale and is preparing to erect the largest mill in northern Ontario, have directed attention to the camp and several hundred claims have been staked since the spring.

MEXICO

PRODUCTION FROM SONORA.—YAQUIS AGAIN ACTIVE.

SONORA.—In spite of washouts and floods creating soft trackage which prevented movement of trains on the Nacozari railroad for several days during August, the

NACOZARI, SONORA, FROM THE MOCTEZUMA MILL.

shipment of ore from Sonora properties during the month held well toward the average. The report of the collector of customs in Agua Prieta for the fiscal month shows 232 cars totaling 9178 tons crossed during this period, with the estimated value of $1,611,700 gold. As usual, the Moctezuma Copper Co. and other properties in the vicinity of Nacozari had the lion's share, shipping 219 cars or 8792 tons. El Tigre shipped eight cars or 272 tons. Shipments from the other properties were as follows: Las Chispas, 21 tons; San Nicolas, 36 tons; Nueva Potosi, 23 tons; San Pablo, 14 tons; and San Pedro, 20 tons.

Mine operations in the Moctezuma and the southern end of the Arizpe mining districts were complicated during the latter part of the month by the depredations of a band of Yaqui Indians that looted the camp of the San Nicolas company and did some damage at the Archipelago, both not far from Cumpas. Leo G. Cloud, managing director for the San Nicolas company, which is operated by a Douglas corporation, brought to Douglas the first authentic account of the looting of the property. Two Indians, so fair that they resembled white men, led the party, which consisted of 80 men. The leaders were said by Mexicans to be Moro Indians. One of them spoke excellent English and acted as interpreter during the stay in the camp, and it was due to his reasonable attitude that the individuals assembled at the property escaped so lightly. The Indians entered the camp silently at 9 o'clock in the morning, although one member of the band carried a drum improvised from rawhide stretched over a framework of wood. Forming in line before the store kept by Mrs. Carl Knudson, wife of the mining superintendent, the Indians divided into squads and soon had all the employees of the mine and mill gathered at the store, which was then systematically looted, all clothing, cloth, and provisions being brought outside and made into bundles of proper weight for individual transportation. But for the coolness of Mrs. Knudson the camp would have been left hungry when the Indians departed. She suggested to the Indians that it would be unfair to take all the food and leave so many people starving. The Chief at once ordered two large sacks of flour and a small quantity of other goods returned. Mr. Knudson, emboldened by the success of this request, then asked whether the Indians could see any use in holding the property idle during their stay. The Chief told him to select the men he wished to return to work. In a few moments eight men, a sufficient number to operate the mill, were back. The mill run was halted only about 15 minutes altogether. In contrast to the consideration shown the Americans was the manner in which the Mexicans were stripped of all property. Even the most trivial personal belongings were taken from the homes of the Mexican workers, though not an American's belongings were touched. A considerable quantity of stuff belonging to Mexicans which could not be carried away was so damaged as to be rendered unfit for use. From the San Nicolas the Indians turned southward, going by way of the Archipelago mine, which is idle at the present time. The watchman was not molested, but all assaying and office equipment of the company was wantonly destroyed. With the exception of the two leaders, all the Indians were Yaquis of the broncho or wild

THE MILL OF THE MOCTEZUMA COPPER CO.

type. All were ragged and many wore no clothing above the waist line. They were reported to have visited Las Chispas and Babicanora mines near Arizpe, but this was denied by Mr. Cloud. Las Chispas was looted last December, however, by Yaquis and Mexicans, several thousand pesos in money and a large quantity of provisions and supplies being stolen at that time. The quietness of the Yaquis appears to have ended with the rainy season. Mexican federal troops in the Yaqui valley and scattered throughout the district infested are said to be inadequate for protection.

SUSPENSION OF ASSESSMENT WORK

With further reference to the law suspending the requirement for annual assessment work during 1919, it should be noted that oil placer claimants that were not previously granted relief from assessment work are granted relief under the present Act.

Certain difficulties have been experienced in the interpretation of the Act, especially in regard to the provision limiting relief from assessment work to five claims owned by any one person or corporation. In order to avoid confusion and decisions that might be unfair to individuals, an amendment has been introduced before the House to eliminate this provision. If this amendment is passed the suspension will apply to any number of claims. Under the same amendment Alaska is to be included in the territory covered by the Act. The passage of this amendment will be noted in these columns as soon as it has occurred.

COPPER PRODUCTION INCREASING

August production of some of the larger copper companies is reported as follows: Utah Copper, 8,640,000 lb.; Ray Consolidated, 3,805,000 lb.; Chino Copper, 3,321,857 lb.; Phelps Dodge, 12,600,000 lb.; Anaconda, 10,572,000 lb. The two last show a pronounced gain over the July figures, when Phelps Dodge produced 11,122,000 lb. and Anaconda was credited with 9,755,000 pounds.

CALIFORNIA

Alturas.—Lester Reynolds has acquired the High Grade group, in northern Modoc county, and started comprehensive work. Pumps have been installed and machine-drills placed in commission. Supplies are being stored for winter and operations will be continued steadily.

Auburn.—The Parker chrome mine on the Auburn-Grass Valley highway, eight miles from Auburn, has been reopened by J. W. Swanton of Santa Cruz. It is reported $100,000 will be expended on new equipment and development. The mine is located on the ranch of Ivan H. Parker and produced much ore during the War.

Forest Hill.—Ex-Sheriff George McAulay and associates of Auburn have formed a company to operate the Excelsior gravel property in this district.

Grass Valley.—The Union Hill hoisting and pumping plant has been erected at the old main shaft of the Idaho-Maryland group and dewatering of the workings is to commence within two weeks. The five claims composing the Union Hill group, together with all equipment, has formally passed to the Idaho-Maryland Mines Co. and the deed of conveyance placed on record.

Keswick.—The Little Nellie mine between Keswick and Iron Mountain is gradually changing from a gold mine to a copper mine. A drift was driven west 4000 ft.; at the end a shaft 500 ft. deep is to be sunk. Extensive diamond-drilling is reputed to have shown considerable copper ore. The mine is the property of the Pittsburgh and Shasta Gold Mining Company.

Nevada County.—The Narambagua is now drained and all the levels cleaned out. The main shaft is 1134 ft. deep and a new station will be cut at the 1100-ft. level. The erection of a 20-stamp mill will commence at once and a new compressor has been ordered. Thirty men are employed under the superintendency of C. T. Green.——The Idaho-Maryland Mines Co. has erected a temporary hoisting frame and transformers are already on the ground and about ready for the wires.

Weaverville.—Work is being started in the Globe mine near Dedrick, after a shut-down of several months. A. B. Cousin of Nevada is in charge as foreman.

COLORADO

Telluride.—The principal operations in the district are development and construction, much of which is nearing completion. The Tomboy mill is expected to be completed within a few weeks. The Smuggler Union Mining Co. has completed the three-story addition to its bunk-house, and the apartment house is nearing completion. The apartment house is to be a model of its kind, fitted with hot and cold water, electric lights, electric ranges, steam heat, and comfortably furnished. There are 64 apartments of four rooms each. The construction work on the Smuggler Union mill is progressing and should be completed on schedule time. There is still a shortage of labor, which is hindering development work at the mines. It is estimated that about 400 more men, skilled and unskilled, are required to carry out developments planned. Interest in the mines in the vicinity of Ophir is being revived, and there is marked activity in this district. The San Bernardo mine is now under lease to the Valley View Mining Co., of which Otto Beselack is the local manager, and a 100-ton mill is being planned. The San Bernardo carries good bodies of ore, running high in silver, and there is no doubt that the property can be developed into a profitable producer. The Carribeau Trust has resumed shipping, two small shipments, one of ore and one of concentrates, being shipped during the latter part of August. The Belmont-Wagner Mining Co. is shipping steadily from the Alta, but not producing as heavy a tonnage of concentrates as anticipated, partly due to a shortage of miners. John M. Wagner continues to ship steadily from the Cimarron a concentrate carrying high gold.

MICHIGAN

Houghton.—Mohawk is improving its ore tonnage slightly in September and there is a small betterment in the copper contents also at present, so that the output of refined copper for September may reach a better figure than in the past six months. Mohawk mined, in August, 43,200 tons of copper rock. This is practically the same tonnage as was broken down and sent to the mill in July.——Wolverine is continuing to increase its ore tonnage. The actual output for August was 27,500 tons, an increase of 3500 tons over the record for July.——Michigan sent 5885 tons of ore to the mill in August, an increase from 4715 tons for July.

The Champion mine continues to produce at a satisfactory rate. Its output is greater than the Baltic and Trimountain combined. The combined ore output of the Copper Range producing mines for August was 79,000 tons, an increase of 8000 tons over July. Of this total the Champion produced

45,000 Baltic 20,000, and Trimountain 14,000 tons. Both the Champion and the Baltic show the best increases. In July the Champion produced 38,000 tons and the Baltic 18,700.

Seneca shaft is still being sunk. It is in the foot-wall. There is, approximately, 65 ft. more to go before it passes the curve. The third level will not cut the lode in the shaft proper, but will be planned to strike it from the cross-cut. If the lode has not been faulted the cross-cut distance will be 60 ft. for this level. No lateral work is being done on the second level at this time and none will be done until the shaft reaches the third level. When that level is cut there will be a raise to provide facilities for more economical and more efficient development of the orebody at both points of depth. The first level continues to show promising Kearsarge amygdaloid. A total of 325 ft. has been opened in the lode, both sides from the shaft. The north side has been continuous in good copper-bearing rock from the start. The south side ran into a fault, which is one of the characteristics of the Kearsarge lode. That necessitated a little exploration but recently the miners found the promising ground again. This first level rock is being stockpiled and will be milled in the near future, not as a mill test, but simply to prevent accumulation of rock. As soon as a couple of thousand tons is accumulated, enough to keep one stamphead busy for a couple of shifts, a clean-up will be made. Nothing definite has been determined as to the location of the proposed Seneca milling plant, but three sites are under consideration.

Winona now has two shafts operating, although the complement of men is not yet up to its requirements. One hundred men are employed underground.——Victoria produced 130,000 lb. of concentrate in August, which was not up to the usual showing. The underground openings from the 20th to the 27th levels are in normal ore.

IDAHO

Salmon City.—The new mill of the Pope-Shenon mine is expected to make its first run about October 15. According to A. Boulais, superintendent of the mine, the first unit will have a daily capacity of 50 tons, and as conditions warrant other units will be added to meet the plant's crushing capacity of 200 tons. Mr. Boulais says the mine has a large tonnage of copper ore that will average about 5%, and the ore of shipping grade, which is now being mined at the rate of about two cars per week, will run as high as 15%. The company has erected a boarding-house and is now well equipped to handle a large force of men and to conduct operations the year round. At present a force of 35 men is employed at the property.

NEVADA

Austin.—Following discoveries of high-grade gold ore in the Birch Creek district, 10 miles east of Austin, a new town has been established with the name of Telluride. The ore occurs in rhyolite with a lime foot-wall and monzonite hanging. The discovery was made by Jack Cahill, veteran prospector who discovered the property of the Round Mountain company at Round Mountain, and other noted Nevada producers. The vein has been opened for 100 ft. on surface and cross-cut by a 45-ft. tunnel. The entire lode is said to pan gold with veinlets sampling $8000 to $51,000. Scores of claims have been located around the original discovery and a rush is on from Austin, Tonopah, and Goldfield. Austin is the nearest supply point.

Cherry Creek.—Exploration Syndicate No. 2, of New York, has purchased the Exchequer mine from the Exchequer Mining & Leasing Co. and increased its operations. The deal gives the syndicate control of most of the leading properties in the Cherry Creek district. Silver is the principal metal produced. J. W. Walker is manager.

Goldfield.—Goldfield Development Co. has purchased the cyanide equipment of the Aurora Mines Co., formerly operating the Aurora Consolidated at Aurora, and is adding the equipment to the Consolidated mill. Machinery includes classifiers, thickeners, and filters. Besides supplying the mill with water from the Grizzly Bear shaft the company has arranged to receive water from the Silver Pick mine. Ore-bins at the Development shaft have been completed and two more electric locomotives purchased for underground haulage. Four of these locomotives will soon be in operation.——The Atlanta company is completing arrangements for extensive work from the 1400-ft. level of the Grizzly Bear shaft of the Goldfield Development. The work is in charge of A. H. Lawry, general superintendent for the Goldfield Consolidated, and is designed to develop a large area of promising ground.——Red Hills Florence is driving two east cross-cuts, one west cross-cut, and two south drifts from the 500-ft. level of its lease on the Florence Goldfield. The main south-east drift is out 400 ft. from the shaft.——The Florence Divide lease has opened a high-grade shoot paralleling the main vein on the 400-ft. level of the Florence Goldfield. The richer ore is being stored in the John S. Cook bank for shipment by express.——J. B. Kendall, president for the Consolidated Mayflower Mines Co., at Pioneer, has taken a lease on a block on the Cornishman shaft of the Florence Goldfield, 200 ft. north of the Daisy shaft. Cross-cutting has started from the seventh level on a seam assaying $30. It is planned to intersect a shoot from the Jumbo vein at its junction with the Consolidated-Florence vein-system.

Jungo.—Mandalay Mines Co. is installing a hoist, compressor, and machine drills at its property in the Antelope range. Sinking the shaft on the True Vein claim to a depth of 200 ft. is to start immediately. The main vein contains silver and gold. J. F. Dwyer is manager.

Loring.—The Malley shaft on the Nevada Honey Bee is down 110 ft. Cross-cutting will begin at the 200-ft. level, which is expected to be under the schist surface formation. The tunnel is in 225 ft. A good plant, including four-drill compressor and 16-hp. hoist, has been installed. The first shipment from mine assayed $34 per ton. The company has a treasury fund of $250,000 cash. J. H. Bell is superintendent.——The East vein on the Loring Treasure Hill group has been traced for 1500 ft., and in a high-grade streak on the foot-wall ore showing visible gold is found in every opening. The first shipment ran $69 per ton, and there are several hundred tons on dumps that will mill over $10. James Garnier is superintendent.——Mr. Beauchamp, manager for the Jose-Davis company, has opened up an ore-shoot on the Sheepherder 100 ft. long and 60 ft. deep, and has 200 tons developed that he estimates averages $200 per ton. A 30-ton mill has been ordered and is now on the road. Nearly all the veins in Loring carry gold, with small quantities of silver, but several carry silver and copper, with but little gold.

Tuscarora.—Following the discovery of rich silver-gold 'float' the Rose Mining Co. has increased its underground force and started prospecting for the source of the rich ore. In the main tunnel excellent ore has been opened and the management plans to erect a mill in the early part of 1920. F. L. Reeber, of Winnemucca, is manager.

UTAH

Milford.—Machinery has been moved from the old shaft of the Utah-United and installed at the shaft of the Beaver Lake Copper on the property of the Beaver Copper Co., according to word recently sent by A. J. McMullen, manager for the company, to the local offices. The shaft, 460 ft. in depth, will be speedily put into shape for operations. With the completion of this work, a drift will be started to cut the ore.

Park City. Shipments from the Park City district continue to increase. For week ending September 12 4,140,000 lb. as compared with 3,713,480 lb. for the preceding week, was shipped from the district. From now on shipments from the Silver King Consolidated mine are expected to make a steady increase as a result of the recent discovery in the Electric Light claim. At the Ontario, which is the heaviest shipper of the district, considerable work is being done. The following gives the shipments, in pounds, made during the week:

	Pounds
Ontario Silver	1,507,400
Judge Mining & Smelting	1,116,510
Silver King Coalition	1,085,600
Daly West	326,560
Silver King Consolidated	110,000
Total	4,140,000

Tintic.—Ore shipments from Tintic during the week ending September 12 reached a total of 117 cars compared with 129 cars the week before. The shippers follow:

	Cars
Chief Consolidated	34
Dragon Consolidated	19
Tintic Standard	14
Iron Blossom	12
Colorado	8
Eagle & Blue Bell	7
Mammoth	7
Centennial Eureka	3
Victoria	2
Gemini	2
Ridge & Valley	2
Empire Mines	2
Oasis	2
Swansea	2
Alaska	1
Total	117

Theodore Nichols, who for a number of years has been interested in the North Tintic district, is in charge of the development campaign which a short time ago was taken up on the property of the Tintic Empire company. This property lies between the Lehi-Tintic and the Tintic Paymaster and is regarded as a promising piece of mineral ground. Carpenters are now busy erecting buildings and the work of sinking a double compartment shaft was started last week. Officials of the Plutus company have reported a good showing in the face of the drift which they are driving from the bottom of the 1000-ft. winze, the point at which the work is being carried on being 1400 ft. from the surface. It will be recalled that the Plutus got into small bunches of ore on the 1000-ft. level and that a winze was sunk into the ore-bearing limestone before driving was started. It was only a few days ago that sinking was stopped in the winze and driving started.

WASHINGTON

Ferry County.—In Keller the mining situation just now is encouraging. New York capital is reported to be seeking copper investments.—R. Shoemaker, of Jacksonville, Illinois, has succeeded the late J. C. Davis in the management of the mines owned by the Illinois Mining Co. It is intimated that during the present year development will be confined to one mine and that the others will remain idle for the present.

BRITISH COLUMBIA

The Consolidated Mining & Smelting Co. of Canada has declared a dividend of 2½% for the quarter ending September 30, payable October 1 to shareholders of record at the close of business on September 10.

PERSONAL

Note. The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

J. E. Clennel is in London.

J. P. Gordon is at Winnipeg.

F. F. Sharpless is in Tennessee.

Fred. W. Foote has gone to Cuba.

L. D. Ricketts is in San Francisco.

Courtenay De Kalb is at Rio Tinto.

Pope Yeatman is at Salt Lake City.

Olof Wenstrom is in San Francisco.

F. G. Cottrell has returned from France.

Gilmour E. Brown has left San Francisco.

S. Matsubara has left Butte for Mullan, Idaho.

James S. Douglas was in San Francisco last week.

Charles A. Chase has been at Silverton, Colorado.

Seeley W. Mudd was in San Francisco during the week.

J. W. Richards is visiting electro-chemical plants in Norway.

W. H. Emmons 2nd was in New York last week and has gone to Washington.

G. L. Sheldon, formerly of Ely, Nevada, was in New Mexico during August.

C. L. Colburn has been visiting Breckenridge, Leadville, Cripple Creek, and Denver recently.

A. B. Shutts has become general manager for the American Ores & Asbestos Co., Globe, Arizona.

A. I. D'Arcy, vice-president and general manager for the Goldfield Development Co., is in New York.

Robert S. Lewis, professor of mining at the University of Utah, was a visitor in San Francisco last week.

Leonard W. Orynski, Lieutenant in the Engineer Reserve Corps, has returned to San Francisco from France.

Carl Zapffe, geologist for the Northern Pacific Railway Co., has returned to Brainerd, Minnesota, after one month's absence.

William Robertson, smelter manager for the Broken Hill Associated Smelters, is visiting metallurgical plants in the United States.

George Crerar has returned to San Francisco after an absence of eight months in Mexico. He may be reached at 520 Crocker building.

A. H. Lawry, superintendent for the Goldfield Consolidated, has succeeded A. I. D'Arcy as manager for the Wingfield companies at Goldfield.

W. Lorraine Cook, formerly manager for various mining companies in Mexico and South America, is now general manager for the Silvermane Mines Co., a silver, lead, and copper mine in Hinsdale county, Colorado.

Warren C. Prosser, who has been superintendent for the Red Mountain Mines Co. at Ouray for the past two years, has resigned to return to professional work in mineral and oil-land investigations, with headquarters at Denver.

Frederick Lyon has resigned his position as vice-president of the U. S. Smelting, Refining & Mining Co. He will take a trip to Europe for the benefit of his health. He was the first general manager for the Mammoth Copper Co., and in 1904 broke ground for the smelter.

Henry B. Underhill, president of the Selby Smelting & Lead Co., died at his residence in San Francisco on September 14. A more extended notice will follow later.

THE METAL MARKET

METAL PRICES

San Francisco September 15

Aluminum dust cents per pound	60
Antimony cents per pound	9.50
Copper electrolytic cents per pound	21.00
Lead pig cents per pound	6.50 - 7.50
Platinum pure per ounce	$120
Platinum 10% iridium per ounce	$140
Quicksilver per flask of 75 lb	$105
Spelter cents per pound	9.00

EASTERN METAL MARKET

(By wire from New York)

Sept 16 - Copper is quiet and easy. Lead is steadier and higher. Zinc is inactive and lower.

SILVER

Below are given official or ticker quotations in cents per ounce of silver 999 fine. From April 23 1918 the United States government paid $1 per ounce for all silver purchased by it fixing a maximum of $1.01½ on August 15 1918 and will continue to pay $1 until the quantity specified under the Act is purchased probably extending over several years. On May 5, 1919, all restrictions on the metal were removed, resulting in fluctuations. During the restricted period, the British government fixed the maximum price five times, the last being on March 25, 1919, on account of the low rate of sterling exchange, but removed all restrictions on May 10. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the normal rate of exchange.

Date	New York cents	London pence		Average week ending	Cents	Pence
Sept. 10	112.50	61 00	Aug.	5	108 08	55.17
11	112.75	61.25	"	12	110.58	58.02
12	113 00	60 75	"	19	112 68	59 14
13	112 00	61 00	"	26	112.00	60.66
14 Sunday			Sept.	2	111.45	58 93
15	112.87	61 12	"	9	111 99	60 96
16	114.50	61 75	"	16	112.77	61 14

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	75.14	88.72	101 12	July	78.92	99 62	106 36
Feb.	77 54	85 79	101.12	Aug.	85 40	100.31	111 35
Mch.	74 13	88 11	101.12	Sept.	100.73	101.12	. . .
Apr.	72.51	95 35	101 12	Oct.	87 38	101 12	. . .
May	74 61	99 50	107.23	Nov.	85.97	101 12	. . .
June	76 44	99 50	110 50	Dec.	85 97	101 12	. . .

COPPER

Prices of electrolytic in New York in cents per pound:

Date		Average week ending	
Sept. 10	22.50	Aug. 5	22.87
11 Holiday		12	22 20
12	22.25	19	22 33
13	22.37	26	22.83
14 Sunday		Sept. 2	22.55
15	22 25	9	22 37
16	22 12	16	22 29

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	29.53	23.50	20 43	July	29 67	26 00	20.82
Feb.	34.57	23.50	17.34	Aug.	27.42	26.00	22 51
Mch.	36 00	23 50	15 05	Sept.	25.11	26 00	. .
Apr.	33.16	23 50	15 23	Oct	23 50	26 00	. . .
May	31 69	23 50	15 91	Nov	23 50	26 00	. . .
June	32.57	23 50	17 53	Dec.	23 50	26 00	. .

LEAD

Lead is quoted in cents per pound New York delivery.

Date		Average week ending	
Sept 10	5.90	Aug. 5	5.87
11 Holiday		12	5 64
12	5 90	19	5 68
13	5 90	26	5.88
14 Sunday		Sept 2	5.90
15	5 90	9	5 83
16	6 25	16	5.97

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	7.64	6 85	5 60	July	10 93	8 03	5.53
Feb.	9 10	7 07	5 13	Aug.	10 75	8 05	5.78
Mch.	10.07	7.26	5 24	Sept.	9 07	8 05	. .
Apr.	9.38	6 99	5 05	Oct	6 97	8 05	. . .
May	10.29	6 88	5 04	Nov.	6 38	8 05	. . .
June	11 74	7 59	5 32	Dec.	6 49	6.90	. . .

TIN

Prices in New York, in cents per pound:

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	44 10	85 13	71 50	July	62 50	92 00	70 11
Feb.	51.47	85 00	72 44	Aug.	62 53	91 33	62.20
Mch.	54 27	85 00	72.50	Sept.	61.54	80 40	. . .
Apr.	55 63	88 53	72 50	Oct.	62.24	78.82	. . .
May	63.21	100.01	72 50	Nov	74 18	73 67	. . .
June	61 93	91 00	71 83	Dec.	85 00	71.52	. . .

ZINC

Zinc is quoted as spelter standard Western brands New York delivery, in cents per pound:

Date		Average week ending	
Sept. 10	7.70	Aug. 5	7.64
11 Holiday		12	7.64
12	7.65	19	7.86
" 13	7.60	" 26	8.00
14 Sunday		Sept. "	7.89
15	7.60	9	7.76
16	7.55	" 16	7.62

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	9.75	7.78	7.44	July	8.98	8.72	7.78
Feb.	10 45	7.97	6 71	Aug.	8.58	8 78	7 81
Mch.	10.78	7 87	6 53	Sept.	8.33	9.08	
Apr.	10.20	7 04	6 49	Oct.	8.32	9 11	
May	9 11	7 92	6 43	Nov.	7.76	8 75	
June	9 63	7.92	6 91	Dec.	7.84	8 49	

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. Prices, in dollars per flask of 75 pounds:

Date		Sept. 2	95 00
Aug. 19	105.00	" 10	103 00
" 26	100 00	" 16	100 00

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	81 00	128.06	103.75	July	102.00	120 00	100 00
Feb.	126.25	118.00	90.00	Aug.	115.00	120 00	103.00
Mch.	113.75	112 00	72.80	Sept.	112.00	120 00	.
Apr.	114 50	115 00	73.12	Oct.	102 00	120 00	.
May	104.00	110.00	84.80	Nov.	102.50	120 00	.
June	85.50	112.00	94.40	Dec.	117.42	115 00	.

FOREIGN EXCHANGE

Depression continues in the foreign exchanges. Both francs and lire scored absolute new lows, and sterling broke badly. Today's quotation of 4 14¾ is only 2½c above the record low. A postponed steamer sailing that caused a hold-over of bills is held partly to blame, but the main trouble lies deeper—the imperative need of credit arrangement. The German mark has shrunk further to 3.5c, and the Vienna mark to two cents, or discounts of 86% and 92%, respectively, from normal parity.

Apart from such general exchange operations is the special provision being negotiated in the case of Belgium the first European nation, to receive acceptance assistance here through the medium of a proposed additional $50,000,000 loan this time in the shape of 10-year bonds as proposed or else 25 years as desired. Meanwhile an additional credit item in favor of Belgium is reported in the matter of $20,000,000 of locomotives said to be under negotiation with payments suggested in five-year dollar notes. A. B. Leach & Co. Inc. are offering Belgian government bonds of 5% national restoration loan of 1919. It is pointed out that due to the exchange situation these bonds can be purchased for about $1.85 per 1000 francs par value. At normal rates of exchange the value would be $193. Interest return on 1000 francs at present rates is about $6.25 and in case of return to normal rates would be over $9.50.

A ten million dollar shipbuilding order for French interests has been lost owing to the extreme weakness in francs and the inability of the purchasers to pay in dollars. The inquiry was in the hands of an American shipbuilding concern and could have been booked had it been willing to accept letters of credit in francs. The proposed sale by the United States Shipping Board of a number of its Lake-lock type of vessels to France, which would have involved close to $100,000,000, has also been delayed by reason of the unsettlement in foreign exchange.

Although reports are being repeatedly made that Germany has or is about to secure credit on the Eastern market it is hardly probable that she will be accommodated for some time to come, at least not until bankers have had time to make a thorough investigation of conditions in that country. The same applies to some other central European countries, such as Poland, Austria, and Jugo-Slavia. An officer of a prominent bank says his institution is being approached almost daily by various German interests with a request for credits, but in every case application is refused. The bank has three representatives in central European countries studying the situation there, and, until they have reported their findings, the bank is not likely to entertain any proposition from those nations for a long-term credit. It is learned, however, that New York banks are assisting German importers individually with exchanges of credits at a certain rate of exchange. Dollars are advanced here against marks placed to the bank's account in German centres. Selling of these marks is largely responsible for the weakness which the currency has recently shown in the Eastern market.

Bankers place no credence in the report that the German government is attaching American emittances drawn against balances opened since commercial relations have been resumed. They are buying and selling exchange on Germany, and funds are being transferred by their correspondents in the usual way. It appears, however, that the old balances, carried at time of our entry into the War, are still sequestered by the German government which will probably not release them until peace is definitely established.

Quotations on September 16 are as follows:

Sterling:	Cable	4.14 3/4
	Demand	4.14
Francs:	Cable	9 10
	Demand	9 11
Lire	Demand	10.06
Marks		3.50

Eastern Metal Market

New York, September 10.

All the markets have been unusually dull the past week and prices have been easy to firm.

Copper needs have been light and have been met by metal from second hands at levels below those of the large producers.

The tin market has been exceedingly quiet, but spot metal is scarcer and higher.

Demand for lead is better and the outside and Trust markets are very close together.

Prices for zinc have again eased off on very light demand and offerings from dealers and small producers.

The antimony market is unchanged.

IRON AND STEEL

The trade is not taking very seriously the conference of union officials in Washington, and while talk of a steel strike is a disturbing factor, operations at mills and selling activities are proceeding as usual. Leading sheet mills are operating at 95% capacity with tin plate a little better. The steel ingot production for August was at the high rate of 121,036 tons per day which corresponds to an annual output of 37,392,000 tons. The August production was the best this year except January. Late sales for export total 45,000 to 50,000 tons and for railroad car repairs 20,000 tons. One Chicago plate mill has sold most of its 1919 output.

COPPER

Conditions have not changed materially in the last week. What demand there is is small and seems to be easily satisfied by dealers and small producers. To meet this demand electrolytic copper has changed hands at from 22.25 to 22.75c., New York, for early delivery, with Lake copper about ¼c. above these levels. Producers generally, however, are still firm in their quotations of 23.50c. for September and 24c. for October and last quarter for electrolytic, with Lake at 24 and 24.50c. respectively. They are taking very little business and are apparently well sold up for September and for part of October. They are confident of a revival of buying a little later for delivery over the remainder of the year. We therefore quote the market at 22.50c., New York, for electrolytic for early delivery, with Lake more or less nominal at 23c., New York. The outside market is firm today with less metal available from second hands, on a firmer attitude manifest by these sellers. It has been rumored that large producers have been selling surplus metal through second hands, but this has been doubted strongly.

TIN

The market has been a quiet one the past week and there have been no interesting features. Spot tin, both Straits and other grades, has been and is scarce and as a result prices have advanced until yesterday spot Straits was quoted at 56.50c., New York. It appears that the heavy arrivals in August have been absorbed and also that shipping conditions in England are extremely bad, it being difficult to get a shipment off even after it has been loaded. The uncertainty as to a possible steel strike has also caused a slowing down in demand. Buyers have been showing some interest in prices for both prompt and future delivery, but it seems that they have not had the nerve to make purchases. This is another explanation of the slow and drifting market. Tin arrivals in August were 4145 tons, of which 2075 tons came in at Atlantic ports. The quantity in stocks and landing was 350 tons on August 31, with 3590 tons reported afloat. Quotations yesterday were as follows on future shipment tin: September Straits from England, 54.25c., with September-October shipment at 53c.; English Lamb & Flagg early October shipment from England at 53.25c. Spot Straits tin was quoted yesterday in London at £283 per ton.

LEAD

The market has been quiet with business confined to the outside market, where offerings as low as 5.75c., New York, have been made and absorbed. It is believed that these have been pretty well cleaned up. At any rate the market is firmer today at 5.90c., New York, or 5.75c., St. Louis, with the trust price unchanged at 6c., New York, or 5.75c., St. Louis. Some dealers report a very quiet market while others declare that where one carload has been sold at concessions in New York at least 500 tons has changed hands at an equivalent of 6c., New York.

ZINC

Quotations for prime Western have fallen in the past week largely because of a poor demand and because of offerings by dealers and second hands. These have also been buyers to some extent. For September delivery prime Western is quoted at 7.35 to 7.40c., St. Louis, or 7.70 to 7.75c., New York, with a slight premium for October. Most producers are unwilling to do business at present levels and many of the consumers are not interested. Here again the uncertainty regarding a steel strike has been a deterrent factor. There has also been very little export business because of unfavorable exchange rates and German competition. A fair business has been done this week in special grades.

ANTIMONY

There has been no change. Wholesale lots for early delivery are quoted at 8.62½c., New York, with 5-ton lots at 9.25c., New York, both duty paid.

ALUMINUM

No. 1 virgin metal, 98 to 99% pure, is unchanged at 32 to 35c., New York, for wholesale lots for early delivery.

ORES

Tungsten: The market has been quiet because of the uncertainty regarding the duty question. Quotations in the meantime range from $7.50 per unit for Chinese ore to $10 per unit for Bolivian ore, duty to be paid in all cases by the buyer if the tariff measure goes through. There has been no test of the ferro-tungsten market heard of, but prices are believed to be around $1 to $1.25 per lb. of contained tungsten.

Molybdenum: There has been very little change in the situation. New inquiry has appeared but it does not seem to have developed into any business. Quotations are nominal at 75c. per unit in 60% concentrates.

Manganese: Imports of manganese ore in July were 15,585 gross tons, bringing the total for the first seven months of this year to 241,570 tons, as against 274,722 tons to August 1, 1918.

Manganese-Iron Alloys: Although several British producers of ferro-manganese were selling the alloy at $95, seaboard, a week ago, apparently none of them are doing so now. Whether this has been due to the protest of the American producers a week ago to the effect that British makers were dumping in this market, contrary to the anti-dumping law, is not certain.

INDUSTRIAL PROGRESS

INFORMATION FURNISHED BY MANUFACTURERS

BUILDING UP A WORN PUMP WITH THE OXY-ACETYLENE PROCESS

*The type of centrifugal pump used by dredging contractors and mining operators for such purposes as dredging silt, sand, mud, and gravel from the bottoms of channels, and for mining soft ore by the hydraulic mining system, is subject to excessive wear due to the constant abrasion of the sand and gravel against the inner walls of the pump chamber. When the wear becomes so great as to interfere with the operation of the pump, or 'sand-sucker', as it is commonly called, it becomes necessary not only to put the pump itself out of commission for repair but also to hold an expensive dredging barge and its crew in idleness.

Building up the Abraded Surfaces. 1264 lb. of High-Carbon Steel was Welded on

Such a sand-sucker chamber that had become badly scored through use was recently restored to practically its original condition by the Chicago job welding department of the Oxweld Acetylene Co., by means of the oxy-acetylene process. When it is considered that new castings would have cost about $3500 and that the actual cost of repairing by welding methods amounted to only one-third as much, it is not surprising that the contractor decided to repair instead of to replace, especially in view of the still more important fact that repairing enabled him to get the dredge back into service with only a few days delay, whereas replacement meant a delay of from 10 to 12 weeks.

In order to gain some idea of the cost of a delay due to the breakdown of a hydraulic dredging outfit, an estimate of the earnings of a dredge will be given. In the year 1912 the U. S. government estimated the cost of hydraulic dredging to be 7.18c. per cu. yd. This figure represented the average total unit cost of operating a fleet of hydraulic dredging-vessels. The record for one month for one dredging-pump having a 20-in. outlet pipe was 456,000 cu. yd. of material. At the average unit cost given above, the monthly cost of dredging this amount of material was over $30,000. The sand-sucker shown in the illustration is much larger than the one referred to above. Furthermore, the cost of materials and labor is much greater today than in 1912. When such factors as loss of profits, overhead expenses, nonproductive labor, and contract penalties are taken into consideration, obviously every week of idleness meant a loss of thousands of dollars.

Steel Casting of Centrifugal Dredging Pump, 14 Feet Outside Diameter

The pump chamber of the sand-sucker illustrated is 14 ft. in outside diameter, and consists of two massive steel castings having a total weight of 7 tons. The abrasion had been so severe it was necessary to re-build both side walls of the pump chamber for a distance of 8 in. from the inner circumference. The thickness of the added metal varied from 1½ to 2½ in. In addition, a new section approximately 14 by 18 inches in area had to be welded into the throat of the casting. The latter was approximately 3½ in. thick.

In order to ensure holding the two halves of the chamber in alignment during preheating and welding they were bolted together and the heavy outer reinforced sections of the castings were not heated, as this would have produced internal strains, either breaking the castings or shearing the

*From Engineering Department, Oxweld Acetylene Co., Chicago, Illinois, and Newark, New Jersey.

bers that held them together. Preheating by means of charcoal was applied locally for a distance of about 14 in. from the edges of the flanges, each preheat extending for a distance of 3 ft. around the inner circumference.

The total weight of steel added to the castings by welding amounted to 1264 lb. The operators, each using an Oxweld blow-pipe fitted with No. 15 welding head, worked in pairs. As the heat in the small enclosure where the men worked was intense, it was necessary to hold several welders in reserve and to work on the relay plan, each welding shift extending for a period of 20 minutes. Six days were required to complete the building-up work.

As the built-up surface will be subjected to the same abrasive action of sand and gravel, high-carbon steel welding rods were used for the purpose of building up, thereby giving an extremely hard surface, in fact, one that it was impossible to cut with a file, after cooling.

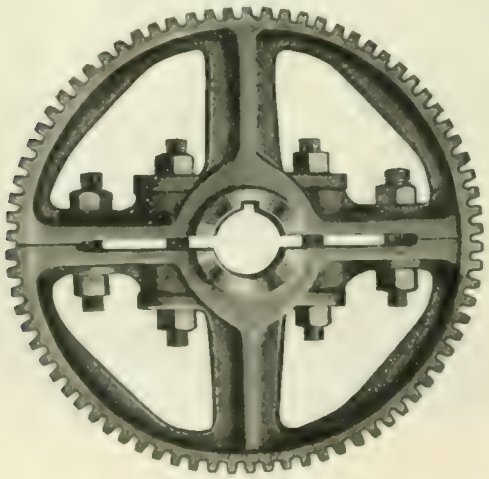
The oxy-acetylene welding work saved the contractor the expense of several weeks of idleness, nearly $2500 in cash on the cost of the casting alone, and gave him a pump actually improved in construction, because lined with abrasion-resisting steel.

HEAT-TREATED GEARING FOR MINE LOCOMOTIVE

By J. E. Mullen*

Gearing is an important item in the chain of equipment, parts, and supplies, which, when linked together, go far toward making continuous operation of machinery possible, and too much attention cannot be given to this fact. This is true not only for locomotive gearing, where broken gears or pinions result in serious delays to haulage systems, but for all other gearing in and about mining operations.

As far as gearing is concerned, the delays most commonly experienced can be successfully combatted only by using a superior grade of material. Case-hardening was the first step in this direction, and although gearing so treated was better than untreated gearing, it was not the best treatment



Typical Heat-Treated Gearing

for mine service because the glass-hard surface with soft core or centre, although resistant to abrasion, did not have the necessary toughness to withstand the severe shocks and stresses to which mine gearing of all descriptions is continually subjected. Consequently extensive research and experimental work was necessary in order to perfect a treatment better adapted to mine conditions.

Two important points must be considered by the mine operator when selecting the type of gearing best suited for his purpose, especially for use on locomotives. These are hardness and toughness, and one is just as important as the other. A gear or pinion with great surface hardness and soft core is unsuitable, because, although capable of giving long service if steady and continual wear were the only considerations, such gearing is unable to withstand breakage due to the many stresses and shocks incidental to mine service. On the other hand, although gearing that is tough will prevent breakage caused by frequent starting and stopping, inexperienced motormen, poor alignment of tracks, and other causes, it will not have the necessary surface hardness to wear well. The ideal is a combination of the two good qualities. This combination the Nuttall company has obtained by perfecting specially heat-treated gearing; in fact the principle of the treatment has been founded solely upon these two qualities. The treatment referred to is well known to many mine operators and is fast becoming their standard—namely Nuttall BP grade when applied to forged steel and NP grade when applied to cast steel.

The following service record shows the benefits derived from the installation of treated gearing. One of the Baldwin-Westinghouse mine locomotives equipped with a 35-hp. motor operating over a 5000-ft. haulage road, with two maximum grades of 2½%, around a 75° curve, full trips hauling up grade, covered 4000 miles per year, hauling 100,000 tons of coal during that time. A BP pinion on this locomotive gave 100% service for a period of five years, and was not entirely worn out when removed; during this time 500,000 tons of coal was hauled under the most severe conditions. In five years ten oil-treated pinions would have been necessary, resulting in ten interruptions of service, and, allowing one-half day for each interruption, would have meant a reduction in output of 3000 tons. A case-hardened pinion broke in 1½ years; it hauled 150,000 tons; but the vital point is that it broke. The teeth wedged in the gear mesh, and locked the wheels, and not only was the locomotive disabled but the haulage road was blocked for two hours, which alone meant a reduction of nearly one-half day in production. It will not be necessary to go into further detail with the mine operator to illustrate the saving in ultimate cost effected by having in service the type of pinion whose performance is first cited.

*Manager Railway and Mining Department, R. D. Nuttall Company.

COMMERCIAL PARAGRAPHS

William H. Baker has resigned from the Atlas Portland Cement Co. in order to join the staff of the **Hardinge Conical Mill Co.** as vice-president.

The McFarlane-Eggers Machinery Co. of Denver has shipped a gasolene locomotive equipped with Ford engines to the Western Zinc Concentrating Co. of Leadville, Colorado.

John Kelly, who for a number of years was New York district manager of the **Edison Storage Battery Co.**, has been appointed general sales manager for the company, with headquarters at Orange, New Jersey.

The Western Machinery Co. of Los Angeles has placed on the market a new Diesel engine, known as the 'Western'. This is manufactured in sizes of 25 b-hp. cylinders in multiples up to four, and operates on low-gravity oils.

The Worthington Pump & Machinery Corp. announces its purchase of the plant, patterns, accounts, patents, and other assets of the Epping-Carpenter Pump Co., at Pittsburgh, Pennsylvania. The plant will be operated as the Epping-Carpenter Works. Orders and contracts now in hand will be completed by the Worthington Pump & Machinery Corp. and all further business will be for its account. Remittances should be made to and all correspondence should be addressed to the Worthington Pump & Machinery Corp., at the Epping-Carpenter Works, No. 10 43rd street, Pittsburgh, Pennsylvania.

WATER in Arizona is receiving attention. The Arizona Resources Board, which was organized under an act of the last legislature, is gathering data and will recommend means for developing the water resources of the State. The investigation will cover all phases of the subject, including water power and water development for mines.

ELSEWHERE in this issue we publish an article on the origin of quartz in veins, written by Mr. George J. Bancroft, of Denver, whose experience in mining covers regions widely separated, as the text of the article suggests. We feel assured that many mining engineers, as well as geologists, will find the article stimulating to further inquiry and observation.

HERBERT HOOVER, who has just returned to San Francisco, according to the Manchester 'Guardian' was the nearest approach to a dictator that Europe has had since Napoleon. This was natural. At a time when, to many of those disrupted peoples, food is more important than gold, the key to the granary may easily be an instrument of greater power than the scepter. It will be remembered how the last of the Hapsburgs, recently attempting to erect a new throne amidst the ruins of Austria, stepped hastily down at a short command from the man who directed the distribution of food to the starving people of Eastern Europe. Food is the supreme essential; kings and armies alike collapse when they are hungry; and he that controls the food supply wields the most potent weapon mankind has yet discovered.

SILVER is one of the metals that was brought into unusual prominence by the War, and, like so many commodities of a different type, it fell under Government restrictions as to price and distribution. By agreeing to purchase at $1 per ounce, the Government prevented the price falling below that figure, at the same time that it fixed a maximum of $1.01½ and directed to England at this price all the silver we could export. The embargo was removed at the signing of the Armistice, and the other restrictions in last May. The agreement to purchase at $1 is still in force. There has been some discussion as to the effect of these restrictions. One side contends that the price at which the silver was sold to England was too low, and points to the fact that China at that time was bidding $1.30 per ounce. The argument is not against the policy of directing the silver to the London market, which was considered a war necessity, but rather that the price was not properly adjusted. The other side contends that with a free market there would not have been the excessive demand from the Orient, and that the price would have dropped below $1 per ounce. In other words, the Government maximum of $1.01½ was designed to give, while directing our silver to the war zone, compensation equal to that which would have been obtained in an unrestricted market. Under 'Discussion' we publish an interesting letter on this subject from Key Pittman, U. S. Senator from Nevada. Senator Pittman was the father of the Pittman Silver Bill, and writes in defence of the Government restrictions. We commend his letter to all who are interested in the status of silver.

THE Government explosives plant 'C', at Nitro, West Virginia, one of those built for the manufacture of smokeless powder during the War, is being offered for sale. An idea of the scale on which explosives were produced may be gathered from the equipment of this single plant. The ground covered is 1800 acres; the improvements consist of 737 manufacturing buildings, and housing accommodations for 20,000 persons. There is a sulphuric acid plant with a capacity of 700 tons per 24 hours; a nitric acid plant with a capacity of 300 tons; a cotton purification plant with a capacity of 225 tons; a power plant of 35,000 hp.; a 400-bed hospital; and the water, sewage, lighting, telephone, and railway systems of a modern city. The Government recommends that capitalists interested in different units of this remarkable plant should associate themselves together and submit a bid on the entire property. We hope that a sale will soon be made, whereby equipment built for highly-organized destruction may be turned to less violent purposes, and in the manufacture of peaceful commmodities offset some of the scarcity that is now so troublesome.

AS we go to press, preparations for the steel strike are completed, with both sides stated to be ready for a decisive battle. Reports have already come in of rioting and crowds dispersed forcibly by the Pennsylvania State Police. At a time when all far-sighted men are calling for more production as the only method of combatting the post-War scarcity of commodities and the resultant high cost of living, this strike seems a particularly stubborn piece of foolishness. Called in defiance of the requests of both President Wilson and Samuel Gompers that action be postponed until after the Labor Conference in October, it is not clear how the steel-workers ex-

[illegible] to profit by a trial of strength just at this time. Indeed, as we have been able to sense public opinion, Labor will be fortunate if it does not lose much that it has gained recently. The open-shop is proclaimed as the principal issue, but another can be dimly seen, namely, a challenge to the leadership of Samuel Gompers by John Fitzpatrick, president of the Chicago Federation of Labor and chairman of the steel-workers' committee. Samuel Gompers has proved himself a sane and conservative leader as well as a good patriot, under whose skilful guidance Labor has made many strides in this generation. To ignore his wise council in order to hearken to the less responsible and more radical element can but result in eventual injury to the cause of Labor.

Blast-Furnace v Reverberatory

The relative advantages of blast-furnaces and reverberatories has always been a fruitful subject for discussion among smeltermen. Although each has its advocates, of late years opinion has leaned more toward the reverberatory, a leaning that has undoubtedly been influenced by the development of flotation and the resultant large quantities of fine concentrate to be smelted, and by the economies of coal-dust firing. Faced by the necessity of using the reverberatory for much of their smelting, metallurgists began to consider the possibility of using it for ores that were customarily smelted in the blast-furnace. Recently we have had the pleasure of publishing several articles on this subject, notably from Mr. Oliver E. Jager, describing the practice at Anaconda, from Mr. Walter G. Perkins, an enthusiastic champion of the reverberatory, and from Mr. E. P. Mathewson, who from his wide experience states that the blast-furnace is still able to hold its own. On another page of this issue Mr. C. V. Corless also takes up the cudgels in defence of the blast-furnace, with special reference to the Sudbury Nickel district, the present smelting practice of which he gives in brief outline. Mr. Corless, as manager of the Mond Nickel Company, is well qualified to know whereof he speaks. It will be observed that he mentions the occurrence of pyrrhotite and pyrite as one of the factors influencing a decision in favor of the blast-furnace. This obviously refers to the fuel economies possible with pyritic smelting; yet we would suggest that in many ores a high sulphur content has no such value, and is therefore not a decisive factor. In the Sudbury district, for example, nobody has yet succeeded in smelting the ores pyritically, although many exceedingly able men have tried to do so with great persistence. The sulphur there is a direct disadvantage, requiring either the expense of a preliminary roast, if a high-grade furnace matte is desired, or else a large and expensive converter plant to handle the increased quantity of low-grade matte that would be produced by smelting green ore. The International Nickel Company has chosen the preliminary roast for its coarse ore; whereas, according to Mr. Corless, it is the intention of the British-American Nickel Corporation to follow the practice at Evje, smelting its coarse ore green and adding its fine to the converters while 'blowing' the low-grade matte.

In most districts the problem is a complicated one, and skilled metallurgists hold divergent views. The reverberatory can be fired with a pulverized coal that is too low-grade for most uses, and much cheaper than coke; it offers the possibility of still greater fuel economy through the use of regenerative firing, rather than utilizing the waste heat for power generation; it avoids the cost of the power necessary for the blast; it is, with its roasting furnace, a complete plant in itself, smelting both fine and the flue-dust it produces. On the other hand, the advocates of the blast-furnace point to the expensive repairs, which are apparently inseparable from the structure of the reverberatory; to the higher slag-losses; to the necessity for grinding the ore, unless smelting a pulverized concentrate; and to the present experiment for reducing the fuel-cost of blast-furnaces by blowing pulverized coal through the tuyeres. The last, however, is still in the experimental stage. In defence of the reverberatory it must be said that in many plants it is merely a subsidiary department for smelting fine, for that reason not receiving the same care and attention as the larger department that does most of the smelting. Consequently it is, in general, not so economically run; repairs, necessarily high with that type of furnace, become still higher due to lack of standard parts; supervision costs more; every item is likely to show a higher cost per ton than would obtain if the entire tonnage were being smelted in reverberatories. For this reason direct comparisons are sometimes misleading; even the higher slag-losses have come down at those smelters where the tonnage thus smelted has been large enough to justify changes of practice. This brings us to another factor, namely, the cost at any large plant of changing a method already in use. If a smelter is, for example, doing satisfactory work with blast-furnaces, the reverberatory must show a striking advantage to bear the amortization charge of a new plant, unless it is made necessary by a change in the character of the ore. Recently sintering and nodulizing have been coming to the fore; that is, fine ore is agglomerated by heat into lumps and then smelted in blast-furnaces. This promises to be a serious competitor of the reverberatory; it is in use at the plant of the Mond Nickel Company, in Ontario, and has been successfully applied to the ores of the Braden Copper Company. The problem is not to be easily dismissed. Mr. Corless has mentioned the desirability of a thorough comparison of the three methods of smelting 'fine', namely, sintering and smelting in blast-furnaces, smelting direct in reverberatories, and adding to the converter while 'blowing' a low-grade matte. To this list we might add a fourth, that is, grinding coarse ore and smelting in reverberatories. The recent development of high-duty ball-mills has reduced the cost of grinding large tonnages, and for ores that cannot be smelted pyritically, but still require roasting, this is an alternative that always must be considered. Such a comparison, made by a metallurgist experienced in this kind of work, would be of great value to the profession. In the meantime we shall be glad to see a thorough discussion of the subject in these pages.

The Copper of Sinai

American enterprise in mining has found ample scope within the continental limits of the United States, yet divagations to foreign parts have become frequent during recent years, largely on account of the nomadic instinct of the mining engineer. At the time when hostilities were begun in Europe, five years ago, American engineers were exploring old copper mines in the island of Cyprus and were hampered by the suspicion, entirely unfounded, that they were working in the interest of Germans. It is a long way from Los Angeles to Nicosia and its Cyprian hinterland, but even the mention of that association awakens shorter echoes in the halls of history than the examination of the ancient mines of the Sinai peninsula by an engineer representing the General Electric Company of New York. Mount Sinai and New York! That seems a far cry; but are they not complementary? The temptations of Manhattan give point to the Ten Commandments. Yet it was not the search for the tables of stone, but for copper ore, that took the New Yorker to Sinai. He found plentiful evidence of the work done long before Columbus sighted the western continent and long before even the British ancestors of the Pilgrim Fathers had ceased going about in a coating of woad. Sixteen years ago attention was drawn to the oil resources of the Red Sea and in the course of exploratory work along the north-eastern shore of that Arabian gulf the finding of slag-dumps at Wady Hebron awakened interest in the abandoned copper diggings of the Sinai peninsula. The slag assayed 2.77% in copper, of which 1.25%, or nearly half, was in coarse metallic grains. Other dumps pointed the way to the source of the ore at Mt. Samarah, where prospecting operations disclosed a series of veins containing oxidized copper minerals, and some chalcocite, in quartz traversing diorite. Reports were made by French and German, as well as British and American, engineers. The Frenchman disagreed with the German, as was proper, but the report of our Ally (or Associate?) is to the point and brief, so we like it. The French engineer, Mr. Jules Strap, considered the deposits as impregnations along lines of stratification in the "sandstone and schist"; he regarded the specks of chalcocite in the oxidized ore as a discouraging sign because "it has been observed in the Mediterranean basin that the presence of gray copper mixed with oxidized ores in the outcrops indicates a rapid exhaustion of the veins; besides, admitting that this exhaustion might not occur in this case, the surface indications furnished by the oxidized ore are not of sufficient magnitude to expect the presence of sulphide ores at the water-level in paying quantities." Mr. Strap's petrography was probably awry, for other geologists label the rocks differently, but his appraisal seems to have been justified, even the German professor, Dr. Friedrich Kolbeck of Freiberg, agreeing that the extensive surficial showing of copper is due largely to encrustation of the country-rock by malachite. At water-level, 250 feet below the surface, the sulphide minerals were expected to predominate. Widths of ore ranging from 2 to 5 feet and assaying 5 to 10% copper to a depth of 135 feet are mentioned in the progress reports by Mr. M. Wanner, who found an analogy between these prospects and the beginnings of the Anaconda mine at Butte. Another encouraging report was that of Mr. C. H. Stewart, of Alexander Hill & Stewart, probably the most competent of those whose opinions are available. In the end these prospecting operations were abandoned because the copper contents of the veins were too low to meet the cost of working in a locality rendered economically unfavorable by the lack of water and fuel. Old pits and ancient ruins, with bas-reliefs at the mine portals, testified to the time when slave labor was available and copper was so highly valued that the exploitation of these lodes might have been remunerative.

It has been assumed, by Brooks Adams in his fascinating book 'The New Empire', for example, that the search for copper was the incentive to the Egyptian invasion of the Sinai peninsula. Indeed Mr. Adams goes so far as to draw a romantic picture of operations so intensive as to have yielded sufficient copper to give economic dominance to the Egyptians and change the trade-routes of the ancient world. He says that the copper mines in the valley of Maghara were captured by Sneferu about 4000 B.C. and that by aid of the metallic output from these Arabian mines this ancient king brought Egypt to affluence and power, and so forth. In short, he weaves a very pretty story; but, as Huxley said, the tragedy of science is the killing of a beautiful theory by an ugly fact. In 1906, four years after the publication of Mr. Adams' book, a scientific description of the heiroglyphic tablets in the Maghara valley was issued by W. M. Flinders Petrie, the famous Egyptologist, whose skilful interpretation of these ancient monuments and careful observations in the mines themselves has punctured the pretty bubble of history blown by Mr. Adams. In his 'Researches in Sinai', Professor Petrie confirms the earlier inference of the late Henry Bauerman, who, in a paper read before the Geological Society of London, described a geological reconnaissance made by him in this region during 1868, in the course of which he examined the ancient workings of Maghara and identified them as turquoise mines. Bauerman, an English mining engineer well known to an older generation, described sundry small copper workings elsewhere on the peninsula, notably at Wady Khalig, and records the finding of a slag-dump in the Wady Nasb, close to a group of springs, where copper ore was smelted. The dump was 250 by 350 yards, but only 8 by 10 feet deep at the most. He found numerous clay tuyere-nozzles and remnants of acacia charcoal. The ore must have been "extraordinarily poor", he says, and the mining of it was only rendered possible by the fact that it was done "in a period when metals were of nearly uniform value" owing to the scarce production at only a few localities. Petrie observed sundry small heaps of slag and remnants of a furnace. Pieces of crucibles and part of a charge not yet reduced were likewise found by him.

Copper chisels were unearthed in the old turquoise workings, so Petrie concluded that copper ore was brought from other localities to Maghara and there smelted on a small scale for the purpose of fabricating tools, most of which, however, were made of stone. Numerous hammer-stones and stone picks for breaking the rock, in the search for nodules of turquoise, were uncovered. The plentiful flakes of flint scattered through the dumps are considered by Petrie as marking, not the systematic mining of the ancients, but the grubbing and gophering of the Bedouins, who for ages have sought for turquoise amid these old workings without themselves engaging in larger operations. The turquoise, a hydrous phosphate of alumina stained by the phosphates of copper and iron, occurs in veins and nodules in a sandstone of Lower Carboniferous age, as determined by Edward Hull, whose 'Arabia Petræa' is the record of his geologic investigation. In the sandstone the Egyptians excavated galleries and chambers. Petrie speaks of one gallery 24 feet long, 60 to 70 inches wide, and 100 inches high, and of a chamber 5 feet high by 20 feet wide. A room-and-pillar system of excavations was made in the turquoise-bearing sandstone by aid of copper chisels and moils, together with stone picks. The marks of these tools are yet to be seen. The Egyptian name for turquoise is *mafkat* and it is found in monuments of the First Dynasty, 5510 to 5247 B.C. Several attempts have been made, in modern days, to work these turquoise deposits, but they have served chiefly to destroy the remains of antiquity. Just before Petrie made his investigation, English promoters had obtained a concession from the Egyptian government and had taken from the Bedouins, or native Arabs, their ancient resource of turquoise-hunting in order to engage in mining on their own company's account. The enterprise proved a fizzle, but not before the invaders had smashed and destroyed quantities of priceless prehistoric monuments, which in the European market of museums were worth far more than all the turquoise they extracted. It was a villainous piece of vandalism, comparable to the Turkish destruction of the Acropolis at Athens. Petrie arranged with the Egyptian government for the removal of the remaining inscriptions to the museum at Cairo. Adams refers loosely to these inscriptions, particularly that of Sneferu. On the smooth natural face of the sandstone are found figures made by cutting into the surface of the rock, leaving the figures in relief. The largest tablet is 63 by 102 inches. Apparently the oldest mine not blasted into ruins was the one beneath the inscription of Sanekht, the seventh King of the Third Dynasty, about 4950 B.C. This tablet is in a spot that is hardly accessible and it does not make itself visible at more than ten yards; it records the conquest of the district by the Egyptians. This earliest sculpture is strong and true, the drawing is "full of correct character, though simply cut, without any elaboration", says Petrie. The various 'scenes', thus inscribed on rock so as to survive seventy centuries, record the doings of successive kings. That of Sneferu, about 4750 B.C., says: "Sneferu, the great god, giving power, firmness, and life, all health and all satisfaction of heart for ever, smiting the countries." He smote his name across the centuries in any event, for there he stands in action engraved on stone that has weathered seven thousand years. Was ever a more lordly monument! On smaller memorial stones, or 'steles', set upright in the ground, are written the records of successive mining expeditions. Inscribed on these slabs of sandstone are the names of the staff, leaving space on which the lower workmen scratched their names, on blank ends and margins. A precise sub-division of labor was then, as in modern Egypt, the condition for obtaining great results from small minds. One inscription records the arrival of 734 men, indicating the large numbers that were employed. The Egyptians brought all their supplies of food, including water, on trains of 500 asses, across the desert from the shore of the Red Sea. Among the technical men several classes were recognized; one of them was the 'diviser of minerals', or prospector, called in Egyptian *mes en aati*. That this was an important position is shown by the fact that only two were employed on each of four expeditions in which from 300 to 450 men were engaged.

The survival of these inscriptions for seventy centuries is marvellous. Petrie says that "in many cases there does not seem to have been a single layer of sand-grains removed from the face of the rock in the historic period", and he says the lack of rainfall in this region since 5000 B.C. is evident. Hull, however, refers to "a little rain falling annually on the highest elevations" and says that "the chief sources of supply are the occasional thunderstorms, which give rise to floods that descend the valleys in impetuous torrents and with disastrous effects", as is proved by shingle, boulders, and driftwood in the Wady el Ain. That is why the inscriptions were placed high on the faces of cliffs. However, it is for the geologist to reconcile the facts; of the age of these memorial stones there is no doubt. They are the oldest mining records in the world. In a play called 'Miriam, the sister of Moses', performed recently at the Greek theatre, in Berkeley, the Israelites were represented on the Sinai peninsula after their miraculous crossing of the Red Sea. They captured an Egyptian "from the turquoise mines" and were about to use him as a guide instead of Moses, against whom some of them were conspiring. The historic accuracy of the reference to turquoise was probably less accidental than the poor elocution of the actor impersonating Moses, who, as we are told in the Bible, was defective in utterance and therefore let his brother Aaron do most of the talking. The Israelites escaped from Egypt in the reign of Rameses II, about 1270 B.C. The turquoise miners anticipated Moses and his tribe by 3700 years. On slabs of sandstone similar to the 'steles' the Ten Commandments were inscribed. By use of something like a divining rod Moses pointed to the place where a spring issued from the Carboniferous limestone of Sinai. That was long ago, but only half-way to the time when the miner under Sneferu first dug the turquoise..

Blast-Furnace v. Reverberatory

The Editor:

Sir—Recent progress in reverberatory furnace construction and operation has naturally led to increased discussion as to its merits. As frequently happens, there has been a tendency to over-emphasize the relative importance of the apparatus under discussion and to generalize rather too broadly as to its application. This is true particularly in the case of the discussion by Walter G. Perkins in your issue of July 19 under the rather unfortunate title, 'Exit the Blast-Furnace'.

The recent rapid advance in reverberatory smelting has arisen mainly from two causes: (1) the discovery and greatly extended use of flotation, which has contributed to recent profitable exploitation of enormous tonnages of low-grade copper-sulphide ores; (2) the successful introduction of coal-dust firing of reverberatories. This latter advantage of the reverberatory over the blast-furnace may soon be offset by the complete success of experiments now in progress in coal-dust firing of blast-furnaces.

These discussions, however, omit mention of two conditions that, when they are coincident, are of decisive importance to the engineer who has the responsibility of determining the type of furnace to be adopted. These two conditions are (1) the occurrence of pyrrhotite (and generally pyrite also) as a large proportion of the gangue accompanying the valuable mineral in the ore; (2) the location of the reduction plant within easy access to cheap power, generally hyro-electric. Usually the first condition alone is decisive, as in the Ducktown district of Tennessee. But the coincidence of the two conditions leaves the decision unquestionably in favor of the blast-furnace.

These two conditions exist ideally in the Sudbury nickel area. In this district, the great importance of which is not as widely appreciated as it should be, the reverberatory furnace will probably never be a serious competitor of the blast-furnace. Even for the treatment of fine ore and flue-dust, the reverberatory has already in this district one serious competitor and will, within a few months, have a second. At the smelting plant of the International Nickel Co. of Canada, lump ore is smelted, after partial desulphurization in roast heaps, in blast-furnaces. Fine ore surplus is treated in Wedge roasters and, together with flue-dust from all parts of the plant, smelted in a coal-dust fired reverberatory furnace. At the Mond Nickel Co.'s plant, however, which is under my management, all fine ore, together with the small quantity of flue-dust formed, is sintered to lump condition on Dwight and Lloyd sintering machines and added to the blast-furnace charge. This method of treatment, which has been successfully followed for several years, has made it possible to eliminate heap-roasting and has reduced flue-dust from blast-furnaces to less than 2% of ore smelted. The British-American Nickel Corporation's staff has stated it to be its intention to follow the Norwegian practice at Evje, namely, to smelt the unroasted lump ore in blast-furnaces, making a low-grade matte for converting. The fine ore will be smelted in the converters, the capacity of which, in relation to the blast-furnaces, will necessarily be large. Thus the Sudbury district will illustrate three radically different methods of handling the fine ore and flue-dust problem. But it is a reasonably safe prediction that the reverberatory will not, in the near future at least, drive out the blast-furnace.

Even during the transition stage to leaner ores, when the silica content becomes so high that a considerable proportion of the ore treated will require concentration, it will be economical as well as quite feasible, as our technical staff has already demonstrated experimentally, to sinter on Dwight and Lloyd machines a charge containing a high proportion of a mixture of table and flotation concentrate. Not until direct-smelting ore is nearly exhausted and the stage of practically exclusive concentration of low-grade ore is reached, if ever, is the reverberatory furnace likely to become the principal smelting furnace under Sudbury conditions of ore composition and power.

At some future date, a comparison of the advantages and disadvantages of the three methods of handling the fine ore problem above outlined would be very interesting and of considerable value to metallurgists. The single purpose of this note is to call attention to one set of conditions in which the reverberatory furnace is not a competitor of the blast-furnace.

C. V. Corless.

Coniston, Ontario, September 4.

The Status of Silver

The Editor:

Sir—I have just read the contribution to 'Discussion' by Edwin D. Wolfe in your issue of August 16, entitled 'The Status of Silver'. Mr. Wolfe, after quoting from an article by me in which I said "Our Government by promising to buy silver whenever it dropped to one dollar per ounce prevented London from fixing the price

below that amount. In other words, it took the control of the silver market away from London," proceeds to demonstrate that the price of silver followed the sterling exchange market of London.

There is no conflict between the assertions of Mr. Wolfe and myself, although he apparently takes issue with my statements. London always has and does now largely control the price of silver because London is the buyer of probably 80% of the silver production of the world. As long as this is the case, and so long as thousands of separate producers are competing with each other to sell to this one great purchaser, London will control the price of silver.

The only thing that prevented London from reducing the price of silver below one dollar per ounce was the Pittman Silver Bill. To this extent the control of silver was taken away from London. It would have been more accurate if, in the quotation given above, I had said that "The control of London was limited by our Government."

It is also true that our Government did hold the price of silver down to $1.01½ per ounce during the War as far as England was concerned. As England required all the silver that we could supply, this left China and Japan practically without silver to meet their demands. This condition naturally caused these countries to bid high for silver. If the Government had not been directing all the silver to the war zone, there would not have been such an acute demand in China and Japan, and it would naturally follow that their bids would not have been nearly so high. In other words, you cannot take isolated conditions to determine what would have been the price of silver. The fact remains that the price of silver is not $1.30 per ounce at the present time and never has been since the embargo was lifted, although the demand in China and Japan had been cumulating during the period of embargo.

Our departments dealing with foreign relations and with finances bearing upon the War, for reasons which appealed to them, considered the holding down of the price of silver necessary as an aid to winning the War. There was a great effort made to fix the price of silver at 85c. instead of a dollar. In fixing the minimum price at a dollar it was accomplished through a general compromise. Without this compromise probably nothing would have been accomplished and silver would have sold down to 85c. per ounce, as it did sell at the time of the introduction of the Pittman Bill.

Upon the signing of the armistice the Government kept its promise and lifted the embargo on silver. This last act did not accomplish what silver producers predicted would be accomplished. I never expected that it would accomplish what the producers thought it would accomplish and never joined in the optimistic predictions that were made.

I stated in a recent article that one potent remedy would be the combination of the silver producers under the Webb-Pomerene Act for the sale of silver abroad. Such a step, in connection with the Government guarantee of a minimum price for American silver, would complete America's control over silver. To what price silver might then go depends upon too many various monetary considerations for me at this time to venture an opinion.

I think we will all agree that at the present time silver is in a much happier state than gold and probably any other metal. Its future is even brighter.

KEY PITTMAN.

Washington, September 5.

Another Skip-Changing Device

The Editor:

Sir—I was particularly interested in reading Oliver E. Jager's description of the skip-changing device at the Steward mine in your issue of August 9, because I am working on a similar problem at the present time.

The Cleveland-Cliffs Iron Co. is at present replacing with reinforced concrete structures the old wooden headframes at the Cliffs Shaft mine. This mine is opened by two vertical shafts 820 ft. apart, in each of which there is only one hoisting compartment. This necessitates the changing of the skips for cages every half-shift. This is accomplished rather satisfactorily in a manner that I shall presently describe, but the new shaft-houses will make possible the use of a double-decked cage, instead of the single-decked one that we are now using, and the increased height of the cage makes some overhead method of support desirable.

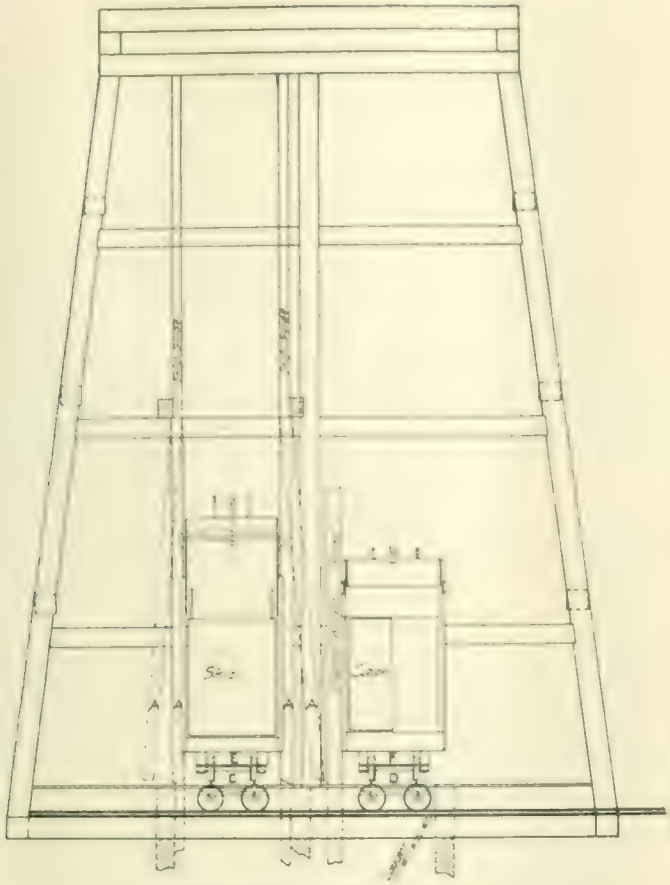
The skip when empty weighs five tons, and the cage about three tons. Half the weight of the cage was added purposely, and it is not likely that the double-decked cage will weigh any more than the one we are now using, but its centre of gravity will be much higher. The method of changing skips and cages is shown in the accompanying drawing, which shows a plan and elevation of the lower part of the shaft-house.

The guides *A* are 24 ft. long, and are hinged at the top, so that they can be moved outward from the hoisting compartment at the bottom. This movement is accomplished by a toggle-switch, which has a throw of one foot. This movement is sufficient to remove the runners entirely from the guide-flanges on the skip or cage.

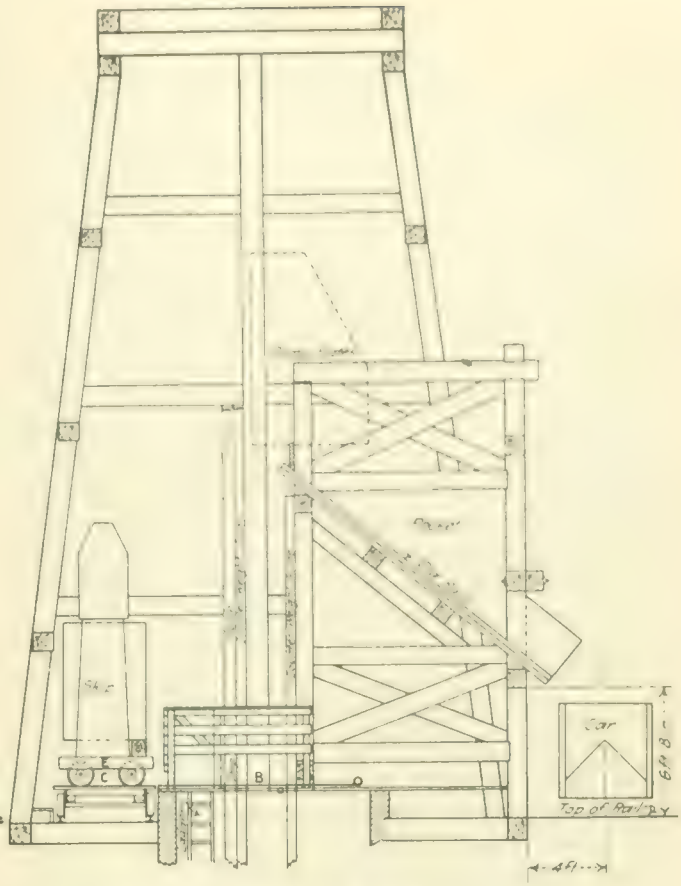
The drawbridge *B* is hinged on a heavy axle of 4 by 4-in. steel, and is counterweighted so that it is easily raised or lowered, and stays up or down without fastening. On it is laid a 24-in. gauge track of 40-lb. rails.

Directly in front of the shaft is a wide-gauge track at right angles to that on the drawbridge. This is set at a lower elevation, so that the rails on the trucks *C* and *D*, which are duplicates, are at the same elevation as those on the drawbridge when it is down. The trucks *E* and *F* are built specially to receive the cage and skip. They run on the tracks on trucks *C* and *D* or on the drawbridge. All trucks are equipped with roller-bearings.

The socket on the end of the hoisting-rope ends in a clevis, of which the bolt is fastened by a chain so that it cannot be dropped down the shaft, and there is a hook just above the clevis to hold the nut, when the bolt is re-



ELEVATION LOOKING WEST



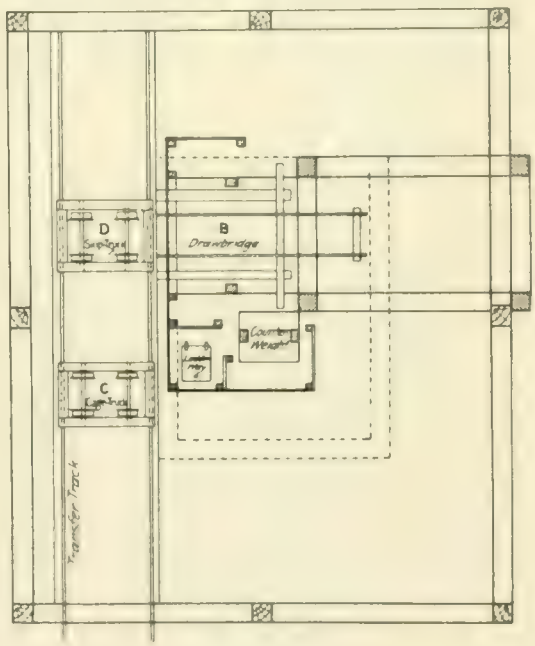
ELEVATION LOOKING SOUTH

moved. This nut is also fastened in position on the bolt by a pin on a chain.

The method of changing is simple. The skip is hoisted far enough above the collar to allow the drawbridge to be lowered, truck *C* is moved to such a position that the rails on its top meet the rails on the drawbridge, and the rails are then locked with a sliding fishplate. Truck *E* is then run on the drawbridge directly under the skip, the skip is lowered upon it, the runners thrown back, and the hoisting-rope slackened till the bolt can be taken out of the clevis. When the rope has been disconnected, the skip is pushed off the drawbridge upon truck *C*, which is then pushed to one side. Truck *D*, with truck *F* and the cage on it, is then pushed into place in front of the shaft, and the process reversed.

This is done at least four times each day, and takes from five to six minutes for each round trip, that is, from cage to skip, and back from skip to cage. I have timed the operation many times with a stop-watch, and the average is close to five minutes. The time of changing will be difficult to reduce, but unfortunately it now takes six men to do the work, and it is heavy work for some of them, especially in the winter, when there is likely to be ice on the track.

The difficulty which our present method will present, when we try it on the double-decked cage, will be the instability of the high light cage, and the difference in the height of the cage and skip. We have two methods of overhead handling under consideration, one of which is very similar to that described by Mr. Jager, but I think



PLAN

he has given me some hints that will enable me to improve on my original plan. I hope that my description of our method of changing skips and cages, which, by the way, has been in use for ten years, may be of similar benefit to other readers of your paper.

LUCIEN EATON.

Ishpeming, Michigan, August 11.

The French Process

The Editor:

Sir—In your review of mining in British Columbia, in your issue of the 23rd inst., you head a paragraph, 'Failure of the French process', for the treatment of complex zinc-lead ores. You are quite unwarranted in making this statement. The plant at this place was only operated, about two years ago, for part of four days and during that short period the results were quite satisfactory.

Failure to operate the process is due to other causes altogether. The company has been struggling for over three years, mainly as the result of a hurriedly drawn up and bungled agreement with the government of British Columbia, which made it impracticable to obtain the necessary capital to put the process to a commercial test, but also to the incomprehensible and paralyzing methods adopted by that government, ostensibly in safeguarding the spending of the money which they have guaranteed to the extent of $65,000. In the matter of who is to blame for the probable loss of this money to the country, I ask you and your readers to suspend judgment, until after the investigation, which I have already notified the Premier I shall demand. For your own information, I enclose a copy of correspondence with the Premier, which still remains unanswered after three months—a not uncommon occurrence.

The coupling of my name with the failure of any process is unjustified, and I hope this letter will remove an impression that might otherwise have the effect of seriously damaging my reputation.

THOS. FRENCH.

Nelson, B. C., August 26.

The Quicksilver Industry

The Editor:

Sir—As a producer of quicksilver I have been interested in the letters you have published on the quicksilver industry and its protection. To quote, in part, the letter of Mr. F. F. Sharpless in your issue of August 23: "In the various official reports that have appeared stress is laid upon the fact that the grade of ore treated in this country has been, for several years, growing lower and lower with no hope of improvement in this direction. That consequently the industry is a declining one which no reasonable protection will bring into activity again, and it may be expected that instead of any permanent or gradually diminishing protection being adequate it will be necessary to continually increase this protection. If those who are personally acquainted with the quicksilver resources of this country can refute this assertion with the proof of the existence of substantial supplies of commercial ore they will add one very substantial argument for the protection desired."

It is not possible to prove the existence of substantial supplies of ore until they are blocked out, usually in a mine. This is the ultimate object of development work. Under ordinary conditions, a deposit, to be developed, must afford reasonable assurance of making a profit; at least, that it will not cause a loss.

When the market for the product is high, there is a great incentive to develop the ore. If it is certain that the high price for the product will obtain for but a short time, the object is to produce as much as possible during that time; no development work for the future being done and the deposit is, in many instances, ruined for future operation. If there is a fair chance of a continuously profitable price, the deposit is developed with care, good equipment is installed, and as much development work done as can be afforded. Advantage is taken of the extraordinary high price under which the enterprise starts to get it on its feet and in shape to meet the future.

The Big Bend district of Texas and across the Rio Grande in Mexico shows cinnabar deposits over a great area. It is not true that the grade of these deposits is growing lower and lower. The fact is, little work has been done on them and they are growing in neither direction. They are low-grade and the uncertainty of the market destroys their attractiveness. There is more than a fair chance that with careful development the quicksilver industry of this district would grow, and in all probability become a valuable resource of the Government in time of need.

The one essential to development is that a market affording a reasonable profit be assured. This assurance can be given only by a protective tariff on quicksilver and its compounds. An excessive tariff is not required but it can be shown that $75 per flask of 75 pounds is a reasonable estimate of the cost of production from low-grade ores. An assured selling price of $100 per flask would result in careful development of cinnabar deposits. It is understood that, as the matter stands, European producers can deliver to and sell in this country at $35 per flask. Such action would stop all development in this country; in fact, it would destroy the industry.

Study Butte, Texas, August 30. E. M. GLEIM

ELATERITE is the common name for wurtzilite, one of the hard varieties of native asphalt, closely similar to gilsonite and grahamite. It is one of the natural hydrocarbons, being composed of 12.23% hydrogen, 80% carbon, and 5.83% sulphur. In 1917, 34,349 tons of gilsonite was produced, as compared with 821 tons of elaterite. Practically all of the elaterite produced in this country comes from Uinta county, Utah, although there are gilsonite mines in both Uinta and Duchesne counties. Refined elaterite is used principally in the manufacture of marine and iron paints, acid-resisting compounds, and other protective coatings, and in the manufacture of rubber. The demand, though small, appears to be steadily increasing as a consequence, it is believed, of the successful employment of this mineral as a primary constituent of prepared flooring. Development of the elaterite deposits in Utah has been retarded by the restricted market for the material, and by the location of the deposits remote from railway transportation.

The President Among the Miners

By T. A. RICKARD

On September 12 the President of the United States delivered an address on the League of Nations at Coeur d'Alene, a town in the mining region of the same name that has made Idaho famous. I happened to be on a visit to the Bunker Hill & Sullivan mine, at Kellogg, and eagerly availed myself of the opportunity to hear the President afforded by the courtesy of my host, Stanly A. Easton, the manager of the mine.

Coeur d'Alene is 42 miles from Kellogg, Idaho; so this is the story of a motor journey and a speech. The motor journey comes first, but the reader can skip it, if he wishes, although I could not.

It was dark and raining heavily when we started at 5:20 a.m., bowling along the cemented pavement that forms a new feature of the settlement clustering around the portal of the Kellogg adit, which is the main entry to the workings of the Bunker Hill mine, now 3500 feet below the surface. The several mill-buildings and the smelter were "lit up like a church" as we passed these evidences of industrial activity that has made the Bunker Hill the premier lead producer of the world. In 1917 the Bunker Hill & Sullivan Mining & Concentrating Company produced 50,000 tons of lead and 1,800,000 ounces of silver, the aggregate value of this output being $9,500,000. Soon we were off the cement pavement and on a macadamized road, but despite frequent puddles the going was good as we splashed through the rain down the sandy flats of the south fork of the Coeur d'Alene river, crossing the railway from Spokane at Cataldo, a name recalling the Jesuit fathers who were the pioneers of the region and founded the Mission, a mile below Cataldo. Father Ravalli and the other French missionaries erected this wooden sanctuary in 1846 and from it extended their beneficent activities among the Indians. The dawn was now breaking through the rain-clouds and we could see the old church silhouetted against the dark wet pine-woods of a mountainous background. For forty years the Mission was the head of navigation on the Coeur d'Alene lake and river, and the point of departure for exploration into the mineral hinterland now made famous by such mining centres as Wallace, Wardner, Burke, Mullan, and Murray.

More immediately important than these historic reminders was the fact that the Mission flats are clayey, so that our car began to skid, being saved from ditching only by the chuck-holes in the road. Eight miles farther, and 19 miles from Kellogg, we stopped to attach chains to our rear tires. This took 25 minutes, during which three automobiles passed us, not without friendly greetings to Mr. Easton. We had the satisfaction of overhauling and passing them within a few miles, for we were in a Franklin roadster, a machine peculiarly suited to adverse conditions. Shortly after attaching the chains we entered Fourth of July canyon, so named by Lieutenant John Mullan, who came this way on July 4, 1854, as was duly recorded by him on the blazed face of a pine near the head of the canyon. This record survives and it is proposed to preserve it as a historic landmark by erecting a fence around it. We were traveling on what is known as the Yellowstone Trail, which is destined to be the motor highway between Seattle and Chicago. As I saw it, and felt it in my bones, it was no Apache Trail or Camino Real, and it required the eye of faith to conceive the changes that would be necessary before this engineering feat would be consummated. For ten miles before passing the Mission we had driven on the abandoned railroad grade that used to be the right-of-way of the narrow-gauge line, built in 1887 by the late D. C. Corbin, the famous railroad builder of the North-West, between Burke and the Mission landing. This railroad was abandoned in 1896, when the Union Pacific's standard-gauge line reached out from Tekoa, Washington, into the Coeur d'Alene country. After entering the Fourth of July canyon we traveled for a mile on the newly reconstructed road; then we were compelled to make a detour among, and over, the stumps and stones of the creek-bed for another mile, during which we tested the resilience of the hickory, aluminum, and rubber of the Franklin car. Here we passed sundry lame ducks on the way, like ourselves, to hear the Chief Executive. Then came a climb up the steep grade, three miles long, that culminates at the Burns summit. This is named not after the poet but after "a long-whiskered stiff who lives at the mouth of the canyon".

Half a mile below the summit we passed a new neat-looking log cabin, which I was told had been ostensibly a gasoline-supply station but actually had served as the seat of a boot-legging industry, namely, an illicit distillery, fully equipped for making a barrel of spirits daily. The chief of these enterprising manufacturers was Ole Linn, a Scandinavian, more honorably known as the discoverer of the noted Sixteen to One mine, on Nine Mile creek. The bootleggers had a great variety of labels, so that the thirsty traveler could obtain anything from Haig & Haig to Sunnybrook.

Next we slid down-hill to Wolf Lodge creek and there hurdled over a big logging-flume by aid of a short bridge so sharply arched that it seemed impossible for a car of long wheel-base to clear it without knocking its drip-pan or differential. The 'negotiating' of this obstacle was made more interesting by the deep chuck-holes that pitted the approach. Just about this time Mr. Easton murmured something about having "a boulevard this time next year," which was most consoling. On the next

hill, above Blue Creek, we passed more motor-cars in obvious difficulties, but not in danger. It was still raining, but the clouds were forming and there was hope of the weather clearing. The face of nature had been washed clean and the forest looked spick and span. Among the pine-clad ranges nestled small valleys checkered by cultivation, chiefly corn, small fruits, and vegetables. Soon we obtained a glimpse of Coeur d'Alene lake, or an important arm of it. Here I may interject the remark that Coeur d'Alene means 'the heart of the awl'. It was a name given by the Indians to a sharp trader and by him and his companions adopted as a name for the Indians and the region they inhabited.

Meanwhile, speaking geologically, we had been crossing the rocks of the Lower Belt series, chiefly quartzite and slate, but now the road began to cross the Columbia River basalt, a flow of Tertiary lava that has determined the topography of this region and created the basin of the lake itself. The columnar structure of the basalt could be recognized on the roadside. I may add, as another geological item, that before reaching Cataldo we could have seen, if it had been daylight, and as I saw two days later, the big granitic boulders that mark the eastern edge of the Glacial ice-sheet, which, descending from the North, blanketed the whole Columbia River country in the days before the foot of man first broke the silence of the primeval wilderness. Descending Nigger Head hill, so named on account of the dark eroded tops of the basaltic columns, we entered upon a fine stretch of road bordering the lake and in a few minutes passed the big saw-mill that marks the northern limit of the city of Coeur d'Alene.

We arrived at Coeur d'Alene at 8:50 and lost no time in housing the automobile and then walking through the town to the place of meeting. This was Blackwell Park, formerly the Fort Sherman reservation. A large tent had been erected and seats had been reserved for delegations from various parts of the Inland Empire, as the Idahoans call their State. Badges had been distributed the day before, so that there was no confusion. Indeed, the arrangements were admirably conceived and efficiently executed, doing much credit to Mr. Robert H. Elder, who, as a member of the National Democratic Committee, had charge of the affair. At 8:50 the President was due at Rathdrum, a station on the Northern Pacific railroad, on his way from Billings, Montana, to Spokane, Washington. He and his party were to come in motors from Rathdrum, which is 17 miles from Coeur d'Alene. This was the only place in Idaho in which he was to speak; probably he wished to deliver an address in at least one town in Idaho and the capital, Boise, was too distant from his itinerary; probably also he wished to speak at least once in William E. Borah's bailiwick, for that Senator is one of the bitterest opponents of the League.

We found our seats readily and watched the assembling of the audience. The tent had a seating capacity of 3000; benches had been provided for only a third of this number, leaving standing room for more than twice as many. By the time the President arrived fully 4000 people were in the tent. National flags hung behind the platform, which was decorated with small flags and Sweet William, or flox; and a large bouquet of the same pink flowers stood on the speaker's table. Three electric lights hung overhead, for, although the rain had stopped, it was a dull morning. From the flag behind the platform there hung a bad lithographic portrait of the President—an unusual and inappropriate decoration, and quite unnecessary, because the cinemas have made us thoroughly familiar with Mr. Wilson's face, pose, and gestures.

While awaiting the arrival of the President, I chatted with the neighbor on my right, H. S. Hull, the Prosecuting Attorney for Shoshone county, and a Democrat. It will be remembered that although Idaho elected a Republican legislature and a Republican State ticket, it gave its presidential vote to Mr. Wilson. Mr. Hull considered him "the greatest master of the English language that had been in the White House"; then he added "at least in recent years," hinting at Lincoln. When I suggested that Lincoln was the greater master of the language, Mr. Hull demurred, insisting that Mr. Wilson had "a more scholarly knowledge of the language and had been favored with better opportunities to acquire skill in the use of it." I did not express my further disagreement. Speaking of Mr. Borah, Mr. Hull asserted that the Senator had lost caste by his tactics, for he had surrendered his judgment to bitter partisanship; the proceedings in the Senate did not reflect public opinion, for sentiment on behalf of the League of Nations is not divided on party lines, "except in so far as leadership at Washington drags that way." He referred to Senator Borah's opposition to sending our soldiers to Europe on the ground of foreign entanglements, yet the Senator had favored American interference with the Irish question and supported the delegation that went to Europe; indeed, Borah had proposed a resolution asking the Peace Conference to take cognizance of the Irish question. This, Mr. Hull thought, served to indicate an inconsistency nourished on illogical partisanship, rather than upon steady patriotism. Behind me a man was reading one of Senator Johnson's speeches. On my left, Mr. Easton, a Republican, was preparing to listen sympathetically to the President, for he favors the adoption of the Covenant as a means of preventing war. As far as I could ascertain the Republicans in this mining region were just as eager to see and hear the President as the Democrats; indeed, his most bitter opponents appeared to be members of his own party, like Harry L. Day, of the Hercules and Tamarack mining companies.

At 9:50 a flap of the tent was raised behind the platform, disclosing Grand Army veterans drawn up in line. At 9:55 C. H. Potts, formerly a State Senator, announced that the President would arrive in ten minutes. He did not, but the announcement was welcome. At the same time Senator Potts, as he is called in memory of his former legislative distinction, requested the ladies to remove their hats, and, as if to show impartiality to the sexes, the men were requested to cease smoking. This provoked laughter. Various delegations were still ar-

rived, the last being one from the St. Joe River country; this had come on a special steamboat down the river and lake. It filled the seats in front of us. By this time the tent was jam full. I was glad we were not in a hall, for the apertures in the canvas insured fairly good ventilation.

At 10:15 the sounds of approaching automobiles excite expectation. The tent is opened again behind the platform disclosing a large crowd waiting and a brigade of 'movie' photographers standing on cars behind the G. A. R. veterans. The thumping of drums heralds the local band, which marches into the tent led by J. V. Hawkins, the postmaster of the town. Then service men in military uniform are received with hearty applause as they take their seats inside. The President is now seen standing in a car engaged in removing his overcoat and by his side is Mrs. Wilson with a large bouquet of red roses. He enters, accompanied by eight Secret Service men, his Secretary (Mr. Tumulty), and his physician (Admiral Grayson) in uniform. The band plays *at* the 'Star-Spangled Banner'. All rise and cheer, but not so excessively as the newspapers suggested. The President and his wife are smiling and bowing. A pause ensues while the party on the platform seats itself. It is now 10:20. David W. Davis, the Governor of Idaho, steps forward. He is a Welshman by birth and used to be a coal miner in Pennsylvania. He speaks to the point and is wisely brief. A Republican himself, he emphasises the fact that the audience is there to meet the President without regard to party affiliations; "the Gem of the Mountain" (that is what Idaho, an Indian word, means) gives to the President the "most generous and sincere greeting that a commonwealth could give to the Chief Executive of the Nation." Mr. Davis indicates the largeness of this commonwealth by stating that it had taken him from 5:25 p.m. on Wednesday until 11:30 p.m. on Thursday to come by rail from the capital of the State to Coeur d'Alene.

The President is wreathed in smiles as he steps forward and shakes hands with the Governor. He expresses appreciation of the invitation to remain longer in Idaho and refers to Washington as "a very interesting place, but it is a very lonesome place." This is received with laughter, of course, and the laughter is renewed when he says that "the people of the United States do not live there."

The President's face bears a latent smile, the result of his frequent appearance in public, and it broadens readily. His enunciation is delightfully clear; he says A-me-ri-ca and A-me-ri-can, giving each syllable its full value. At first he made all his gestures with his left hand, in which he held a slip of paper, bearing notes presumably. His right arm rested at his side. Later he dropped his left and used his right, pointing with the index finger as he scored those who were "opposed to the ratification of the treaty of peace with Germany altogether." He punctuated his speech with "fellow countrymen," and, curiously, began it by addressing the Governor as "Your Excellency". This was overlooked by the press reporters, but it is noteworthy, because whereas precedent warrants the use of 'Your Excellency' when addressing the President of the United States, it is surprising that the President should so address the executive of a State. It might be taken as placing an emphasis on State rights! Mr. Wilson has a good and full voice, but it is not especially musical or oratorical; it has a slightly reedy timbre, but he speaks with unusual clearness and places his emphasis on the right words, a characteristic of all really effective speakers. He looked well and hearty, a remarkably vigorous and alert man, despite his 63 years. Most of us, I think, were agreeably surprised to see no signs of physical weariness, notwithstanding his arduous campaigning across the continent.

His face bore a near-smile most of the time, but it became stern as he referred to "the outrageous thing" Germany had attempted. He carried the audience with him as he said: "Germany attempted to do outrageous things, but Germany is not the only country that has ever entertained the purpose of subjecting the peoples of the world to her will. And when we went into the War we said that we sent our soldiers across the seas, not because we thought this war an American fight in particular, but because we knew that the purpose of Germany was against liberty . . . After long hesitation, after trying to persuade ourselves that this was a European war and nothing more, we suddenly looked our own conscience in the face and said, 'This is not merely a European war; this is a war which imperils the very principles for which this Government was set up [right hand raised with an authoritative index-finger]; and it is our duty to lend them the forces we have, whether of men or resources, to the resistance of these designs. . . . It was America—never let anybody forget this—it was America that saved the world." Describing German ambition and her purpose to make "an open line of dominion," he extended his right hand forward; and when he spoke of the German dream to "open the gates of India" he swung his hand laterally. The purpose of the Treaty was to "set up the very states that Germany and Austria intended to dominate." We have given to these smaller countries a title to their lands; "they never did belong to anybody else; they were loot; it was brigandage to take them; we give them in fee simple" to their rightful possessors. "But what is the use of setting up title if we do not guarantee it. And that guarantee is the only guarantee against the repetition of the war we have gone through, just so soon as that great nation, 60,000,000 strong, can again recover its strength and its spirit."

He dwelt upon the "intolerable" conditions in Europe; the sorrow, dread, and unrest. "America is necessary to the peace of the world. Germany realizes that; and I want to tell you now and here—I wish I could proclaim it in terms so loud that they would reach the world—Germany wants us to stay out of this treaty [applause], not under any deception, never under the deception that we will turn in sympathy toward her, not under the delusion that we would seek in any direct or conscious way to serve Germany, but with the knowledge

stands between man and the jungle. Again he spoke of the suffering in Europe as he himself had seen it and of the dependence of the European people upon American action in bringing the world to settled conditions. "A chill will go to their hearts, a discouragement will come down upon them, cynicism will take possession of them which will make progress impossible, if we not only do not take part, but do not take part with all our might and all our genius. Everybody who loves justice and who hopes for programs of reform must support the unqualified adoption of this treaty." Cheers and shouts greeted this climax. He proceeded to say that "if you want to have your own fortunes held steady, you must realize that the fortunes of the world must be held steady; if you want to keep your own boys at home after this terrible experience, you will see that boys elsewhere are kept at home." The hope of keeping out of war was instantly applauded. "Having given this proof once, I pray God we may not have occasion to prove it again. We went into the War promising every loving mother that we were going to fight a war which would make that sacrifice unnecessary again; and we must redeem that promise or be of all men the most unfaithful." Here he struck a responsive chord; the audience expressed intense approval. "This league, my fellow citizens, is a league to bring about the things that America has been advocating ever since I was born. It is a league to bring it about that there shall not be war, but that there shall be substituted for it arbitration, and the calm settlement of discussions."

Then came an interesting mention of a clause in the Naval Appropriation Bill, a clause whereby he, as President, was directed by Congress to bring about disarmament. "Congress, authorizing a great building program of ships, and the expenditure of vast sums of money to make our navy one of the strongest in the world, paused a moment and declared, in the midst of the Appropriation Bill, that it was the policy of the United States to bring about disarmament and that for that purpose it was the policy of the United States to co-operate in the creation of a great international tribunal, to which could be submitted questions of international controversy. And it directed the President of the United States, not later than the close of this war, to call together an international conference for that purpose. It even went so far as to make an appropriation to pay the expenses for the conduct of such a conference in the city of Washington. And that is a continuing provision of the Naval Appropriation Bill." He asserted that he had fulfilled the mandate of Congress when he came back from Europe with the covenant of the League in his pocket. "And now they don't like it!" he exclaimed, amid general laughter. "There is only one conceivable reason for not liking it, my fellow countrymen, and to me, as an American, it is not a conceivable reason, and that is that we should wish to do some nation some great wrong. If there is any nation in the world that can afford to submit its purposes to discussion, it is the American nation."

The speech did not end here, but I have given the gist of it. The closing periods were marred by the buzz of

an aeroplane closely overhead, distracting the attention of the audience. This aeroplane took photographic films to a newspaper at Spokane. His concluding words were as follows: "It is with the solemn thought that we are at a turning point in the destiny of mankind and that America is the make-weight of mankind that I, with perfect confidence, leave this great question to your unbiased judgment."

The following took place as the President and his party descended at the back of the platform and took their seats in the motor-cars outside, returning to Kellogg on their way to Spokane. He had spoken for three-quarters of an hour. The audience was keenly intelligent and had too much sense to interrupt the flow of his argument with mistimed applause, but it was quick to recognize the telling points of the speech. The mining settlements had sent down a worthy representation and it was a pleasure to feel the touch of earnest citizenship. As we moved out I heard a voice say: "I guess he'll put it over; the people want it." That was my opinion at the moment. It was the first time I had seen or heard Mr. Wilson. He is a man of force and personal magnetism. As I listened to him, and came under the influence of his intellectuality and magnetism, it was difficult for me to realize that it was he who had been guilty of those unfortunate phrases, 'Too proud to fight', 'Peace without victory', 'With the origin and causes of this war we have no concern', and others equally lamentable. These were forgotten as I listened to him; they seemed to belong to somebody else; I saw only an attractive and scholarly gentleman, a clear-headed and accomplished speaker, and a forceful exponent of the American idea.

Next day I interviewed some of those who had gone from Kellogg to hear the speech, and thus obtained the impressions of a number of men representative of the mining community.

Ira ('Bud') Robson, a demobilized soldier and secretary to the manager of the Bunker Hill mining company, said: "It was a straightforward speech. He impressed me that he believed what he said. It changed my opinion about the League; I was sort of opposed to it when I went down; he has made me feel interested in it, for his arguments were strong."

Richard A. ('Dick') Brockman, engineer in charge of the power-plant, said: "It was very much what I have read in the papers. I expected something new. There was too much about the Treaty and not enough about the League. After going over such a bad piece of road, I expected something more worth-while."

J. E. Sturdevant, secretary of the Kellogg Y. M. C. A., said: "I am not in his class politically, but I was much impressed. I was surprised at what he said, perhaps on account of my political prejudices. He made out a pretty good case; without doubt, we ought to have a league, but not quite the kind he advocates. I want to hear what Johnson has got to say."

Daniel ('Dan') Straw, who works in the blower-house at the smelter, said: "What I could understand I thought all right. As to the League, he did not say much about it, especially Article 10, which is more than I can understand. If it is for the benefit of America, I'm for it; but no common man has the education to decide on the question. That was such a hellova road and I am so shook up that I can't think straight."

Peter Albinola, a native of Italy, an American citizen, a pioneer of the Coeur d'Alene, and a retired saloon-keeper, said: "It struck me as the best talk I ever heard. Whatever he said, he said through his heart, like a good American. That man is the very father of the country, not because I am a Democrat either. I can see nothing wrong with this League of Nations, although I read the papers carefully. Every time he speaks, he says something; some fellows make a hellova long speech and say nothing."

G. O. Parrish, pastor of the local Methodist Episcopal church, said: "To me Mr. Wilson is a great personality, so I expected to be greatly interested. His language is exceptionally clear and he is an idealist, of course; but he failed to convince me that the League in its present form should be adopted. I am already convinced that we do need a league against war, but he did not prove to me that the present covenant is the one to do it. He did not drive from my mind the idea that reservations are needed in order to conserve and preserve our American rights."

Quot homines tot sententiae. This does not refer to the saloon-keeper, but I do confess that when I tackled Mr. Straw I expected to ascertain which way the wind blew. Evidently he, Mr. Brockman, and others retained a lively recollection of the motor-ride up Fourth of July canyon and it is patent that the turpitude of the road influenced their mental processes as they listened to the Chief Executive. To me the road, with its slithers and chuck-holes, the rain overhead and the mud underfoot, served but to bring into relief the clearing weather afterward and the intellectual comfort of listening to a great man. As the horrors of the recent war had preceded the conference for a perpetual peace, so the minor discomforts of that journey were forgotten in the hope, expressed so eloquently by the President, of establishing stabilized conditions, in which "America should lead the world out of darkness into the light."

FLUORSPAR is utilized principally in the metallurgical, ceramic, and chemical industries. The bulk of the domestic output, mainly gravel spar, and practically all the imported spar is used as a flux in basic open-hearth steel furnaces, so that the demand fluctuates with the rise and fall in the production of steel. During 1918, 263,817 short tons, valued at $5,465,481, was sold, compared with 218,828 tons, valued at $2,287,722 in 1917. This represents an increase in quantity of 44,989 tons, or nearly 21%, and in value of $3,177,759, or nearly 139%. The increase was caused mainly by the increased demand for steel for use in the War. Fluorspar was mined and shipped in Arizona, Colorado, Illinois, Kentucky, New Mexico, New Hampshire, Utah, and Washington. The average selling price per ton f.o.b. mines or shipping points for all grades of spar was $20.72.

Some Engineering Features in Connection With the Utah Copper Company's Operations

By R. C. GEMMELL

The Bingham & Garfield Railway. In order to ensure the proper and economical handling of its ore, the Bingham & Garfield railway was built during 1910 and 1911 by the Utah Copper company. The road traverses the eastern slope of the Oquirrh mountains from the mines, at Bingham, to the mills and smelter, at Garfield; the distance on the main line from station to station being about 20 miles. Branch lines to other industrial points increase the total length of the line to 37 miles. Additional tracks for serving the Utah Copper company and other mining companies at Bingham total 43.5 miles. This, together with about 53 miles of yard and siding tracks, makes the total length of all tracks 133.5 miles, as shown upon the map, Fig. 1.

The Denver & Rio Grande railroad already had in operation a road between Bingham and Garfield; this followed a winding and circuitous route between the mines at Bingham and the Magna plant, the distance between these two points being 27.5 miles. During the spring of 1908, the Utah Copper company engineers made surveys which proved that a more direct line could be built without encountering insurmountable difficulties, and in the spring of 1910 it was decided to begin construction. Surveys were made and lines were projected on grades varying from 2 to 2.5%, and, at first, a maximum curvature of 12° was assumed. A maximum grade of 2.5% was finally adopted upon the assurance of locomotive builders that they could furnish an articulated Mallet compound engine capable of hauling 40 empty cars of 60 tons capacity up such a grade at an average speed of 12 miles per hour. It was found practicable, except in two cases, to use nothing greater than 8° curves. These two exceptions, namely, a 10° 10-ft. curve for the Dry Fork crossing and a 10° curve immediately below, were employed in order to effect large savings in the cost of construction.

The greater portion of the road consists of heavy cuts and fills along the mountain slope. Just above the town of Bingham, however, because of the danger to the buildings in the canyon directly below and because of the excessive curvature that would be required to follow the canyon closely, it was decided to use the more costly method of tunnels and high viaducts. Starting at the mine, the road first crosses Carr Fork canyon on a steel viaduct of the tower-and-girder type, 690 ft. long and with a maximum height of 190 ft. See Fig. 2. From this viaduct the line traverses the Bingham assembly-yards and crosses Markham gulch on a second steel tower-and-girder viaduct, having a length of 640 ft. and a maximum height of 225 ft. After crossing Markham gulch, the track passes through four tunnels; the first is on a 3° curve, with a length of 1282 ft.; the second and third are on tangents, with lengths of 2085 and 773 ft., respectively, and the fourth is on a 6° curve, with a length of 682 ft. The last viaduct on the line—the one across Dry Fork—is also of the tower-and-girder type, with a length of 670 ft. and a maximum height of 188 ft. This viaduct is on a 10° 10′ curve, the curve forming a horseshoe having a total angle of 195° 42′. The line from Dry Fork to Magna runs through rough country, along and across the foothills, necessitating heavy cuts and fills, which render construction expensive. See Fig. 3. The entire line from the assembly-yard at Bingham to the Magna plant has an average grade of 2.05%; the distance being 17.2 miles, and the elevation at Bingham 6331 ft., whereas the altitude at Magna is 4457 ft. above sea-level.

The tunnels are all single-track, 18 ft. wide and 22 ft. high above the top of the rails. About half of the length of the tunnels is unlined. Where timbering was necessary, the three-segmental arch, with timber-plates along the tops of the posts, was used. The timbered sections are rendered partly fire-proof by means of redwood strips, inch-boards being used on the side segments and two-inch boards on the top section. In order to economize labor and permit of more rapid progress in tunneling, a 'jumbo,' or loading machine, was so devised as to permit the excavation being done on three benches simultaneously. This 'jumbo' was so constructed as to allow the broken rock from the two upper benches, or headings, to run into the cars by gravity, but it was necessary to shovel the rock from the lower heading. This arrangement made possible an average progress of about five feet per day. In order to rush the work as much as possible, air-drills only were used. Two crews, advancing from each end of the openings, were employed at all times. The work was so well planned and skilfully executed that it was completed on time, and with no fatal accidents to mar the record of the achievement. After the tunnels were completed, in order to have an accurate record of the yardage removed and a sectional outline of the openings, a tunnel-sectioner was devised and used with good results.

The care of the drainage along the right-of-way in the more mountainous portions of the road proved to be difficult. The standard openings adopted were concrete arches, varying in span from 3 to 10 ft. The greatest difficulty in draining was encountered in deep steep

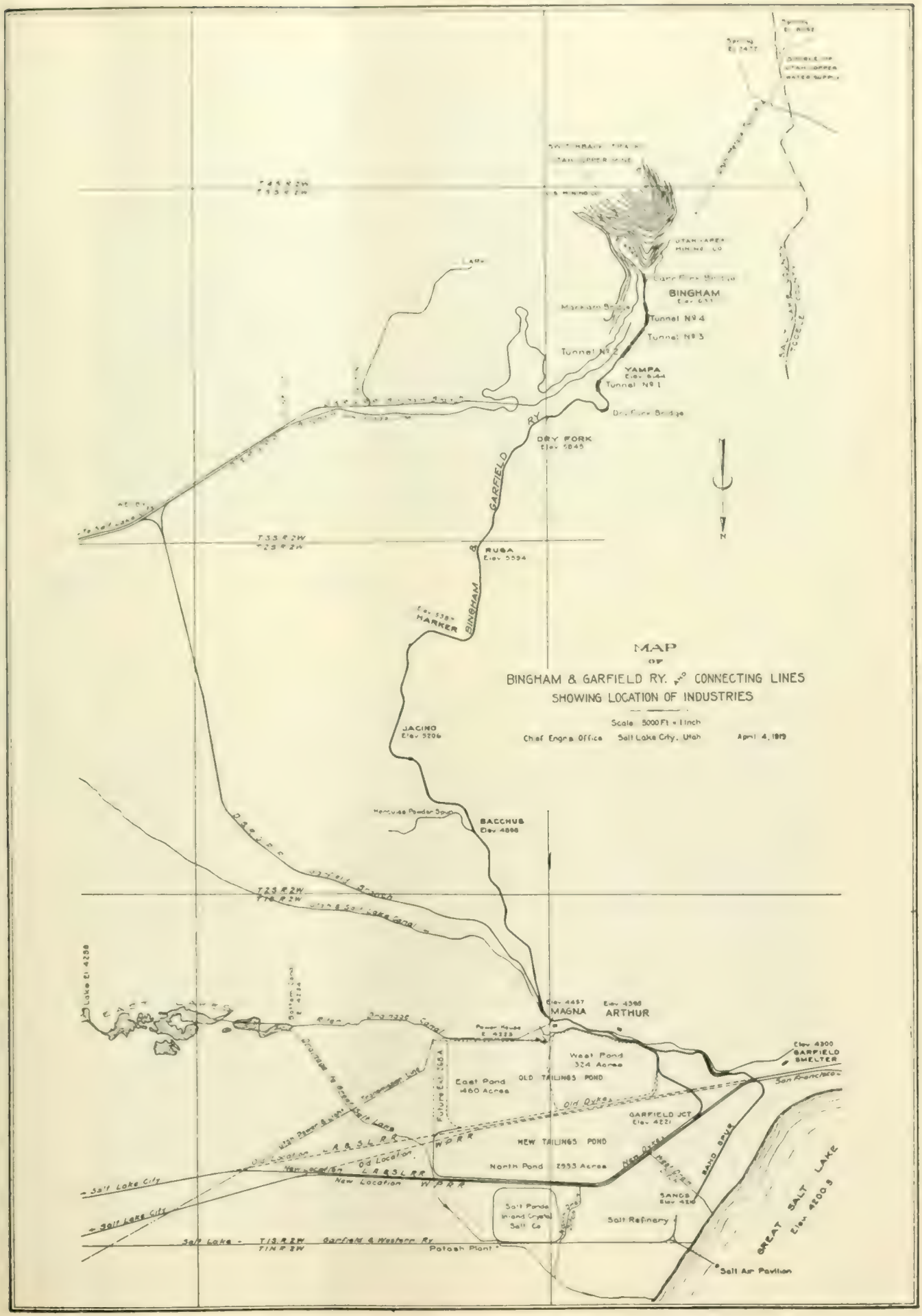

MAP
OF
BINGHAM & GARFIELD RY. AND CONNECTING LINES
SHOWING LOCATION OF INDUSTRIES
Scale 5000 Ft. = 1 Inch
Chief Engr's Office Salt Lake City, Utah April 4, 1919
BINGHAM
Elev. 6331
Tunnel No. 4
Tunnel No. 3
Tunnel No. 2
YAMPA
Elev. 5444
Tunnel No. 1
DRY FORK
Elev. 5045
RUBA
Elev. 5594
MARKER
Elev. 5381
JACINO
Elev. 5206
BACCHUS
Elev. 4898
MAGNA
Elev. 4487
ARTHUR
Elev. 4398
GARFIELD SMELTER
Elev. 4300
GARFIELD JCT.
Elev. 4221
SANDS
Elev. 4230
GREAT SALT LAKE
Elev. 4200 ±
West Pond
324 Acres
East Pond
460 Acres
OLD TAILINGS POND
NEW TAILINGS POND
North Pond
2933 Acres
Salt Ponds
Inland Crystal
Salt Co.
Salt Refinery
Potash Plant
Salt Air Pavilion
BINGHAM & GARFIELD RY.
GARFIELD & WESTERN RY.
D. & R. G. W. R. R.
W. P. R. R.
L. & S. L. R. R.
Old Location
New Location
Salt Lake City
Lake El. 4200
T.2S R.2W
T.1S R.2W
T.1N R.2W
T.1N R.3W

FIG. 1

gulches where the greatest amount of embankment was required. In order to complete the work on time, it was necessary that the grading be done uninterruptedly; therefore it was decided to provide drainage by driving tunnels through the original ground, thus permitting the filling of the gulches without delay. Miners were employed in driving these tunnels, and this method of disposing of the drainage has proved satisfactory in every way.

The contract for the grading and concrete work was given to the Utah Construction Co. on March 30, 1910. Men, teams, and equipment were in place and in operation by the early part of May. Grading was started on April 17, 1910, and the line was completed by April 1911. During this period, the Construction company moved 746,970 cubic yards of solid rock excavation, 618,222 cubic yards of loose rock excavation, and 315,070 cubic yards of earth excavation; it drove 4795 linear feet of railway-tunnel, 818 linear feet of drain-tunnel, used 1,494,416 ft. B.M. of timber for lining tunnels, and placed 11,698 cubic yards of concrete. This is considered a remarkable record in railroad construction on such a comparatively short piece of line.

An ingenious plan, known as the 'Swede trap,' was used in excavating the deep cuts on the road. This scheme involves the driving of a small tunnel along the centre of the cut and just below the grade of the roadbed large enough to accommodate a small dump-car. This tunnel is then protected by timbers loosely placed over the centre and on the grade-line. The material to be removed, after being loosened by blasting, runs onto the boards above the cars and is allowed to fall into the cars in the tunnel below by removing the timbering as required. In some of the larger cuts, as much as 95% of the excavation was handled in this manner.

The contract for the steel viaducts, aggregating 3000 tons of structural steel, was given to the Kansas City Structural Steel Co. This company had the plates and girders fabricated by the Pennsylvania Steel Co. and the towers fabricated by the Minneapolis Steel & Machinery Co. The actual construction was done by the Garrick & Garrick Construction Co. The work had been so well planned and placed in the field, and the steel so accurately fabricated in the shops, that no difficulty was encountered when the viaducts were erected. The concrete piers upon which the towers are constructed are 5 ft. square on the top and 9 ft. square at the largest section. They are built with a batter of one-half inch per foot. The height of the piers varies from 12 to 96 ft., depending on the distance to bedrock, upon which all of them are founded.

The heavy-service tracks of the road are laid with 90-lb., open-hearth, A. R. A. section, series 'A' rail. All of the other tracks are laid with 65-lb., open-hearth, A. S. C. E. section rails. Ties of untreated Oregon fir, 7 in. by 8 in. by 8 ft., spaced 18 ties to a 33-ft. rail and fully equipped with tie-plates, are used. The tie-plates under the 90-lb. rail are 8 by 8½ in., whereas under the lighter rails 8 by 8-in. plates are used. All of the heavy-service tracks are ballasted with one foot of crushed rock below the ties.

During the year 1918 the road handled 12,439,394 tons of freight, being an average of 34,081 tons per day. Since nearly all this freight is handled down-grade from the mines at Bingham to the mills and smelter at Garfield, it was found unsafe to operate with more than 40 ore-cars per train, using standard braking equipment, and from actual tests made, it was determined that it was not advisable to load these 40 cars with ore weighing to exceed 56 tons per car when using such standard braking equipment. Therefore, arrangements were made to equip the ore-cars with the empty and load brakes, manufactured by the Westinghouse Air Brake Co. The heavy Mallet type of locomotive had solved the problem of moving empties up the grade at a satisfactory speed, and this special braking equipment was required to permit the safe operation of the heavy trains down the grade.

The empty and load brake so operates as to increase the total braking power, giving practically uniform

braking power on car-units, whether empty or loaded, and regardless of the service in which they are being operated. The special braking equipment is entirely interchangeable with the standard freight-brakes, including the well known quick-service type 'K' retarded release and uniform re-charge freight-triple. In the actual road-tests when using the empty and load brakes, it was found that the cars could be loaded with 69 tons and that a 50-car train could be handled; at the same time maintaining a high factor of safety with a consumption of less than half the air by the standard equipment. Taken as a whole, this equipment has proved very satisfactory, holding the heavy trains to a uniform speed on the 2.5% grades.

The problems of construction and operation of the railroad at the mines were even more varied and complicated than on the main line. The mine being of the steam-shovel, or open-cut, type, it was necessary to construct railroads from the main assembly-yard at the base of the Utah Copper mountain to the various steam-shovel levels. There were 23 of these levels; the one at the top being at an elevation of about 1500 ft. above the bottom level. In addition to the tracks necessary to bring the ore down to the assembly-yards, long level lines were built to permit the removal of the large volume of cap, or waste, from the orebody. Owing to the necessity of continuous operations, the best way of providing facilities for transporting the ore from the various levels was by means of switchbacks, as illustrated in Fig. 4. In

FIG. 2. CARR FORK VIADUCT, WITH THE UTAH COPPER MINE IN THE BACKGROUND

FIG. 3. DRY FORK VIADUCT

object to hasten the mine operations and make them more flexible, the various steam-shovel levels are served at both ends by these systems of switchbacks, and the trackage at the mine is so inter-connected that it is difficult to conceive of an accident or set of unusual circumstances which could seriously interrupt the output of ore.

During the average day's operations, 65,000 tons of ore and waste are transported over the tracks at the mine. The trains are handled by two types of locomotives; the smaller is a 50-ton 4-wheel saddle-tank type; the larger is a specially designed 80-ton side-tank switching locomotive. The smaller engines haul trains of five cars, while the heavier ones are used to serve the upper steam-shovel levels and handle from 10 to 12 cars at a time. Owing to the excessive steepness of the grade on the switchbacks and the sharp curves over which the ore-trains must be moved, unusual care is taken in the operation of the trains up and down the mountain. The present system necessitates the use of flagmen placed at advantageous intervals in towers, from which their view is entirely unobstructed. It is required of the locomotive engineers that they get clear right-of-way signals before they are allowed to move their trains to the next level.

In addition to transporting the business of the Utah Copper company, the tracks of the Bingham & Garfield railroad are available to the various mines at Bingham for freight service; in other words, the entire district has unusually good freight-handling facilities. The road is connected with the Denver & Rio Grande railroad at Bingham and at Magna, and with the Los Angeles & Salt Lake railroad and the Western Pacific railroad at Garfield. Branch lines have been constructed to the Garfield smelter of the American Smelting & Refining Co. and to the Bacchus plant of the Hercules Powder Co., which plant manufactures practically all of the powder consumed in Utah and the adjacent States.

Disposal of Tailing. The Utah Copper company commenced active operations of its mine and of its experimental mill in Bingham canyon on the first day of July 1904. At that time the ore-reserves were estimated at 37,500,000 tons. The Magna plant at Garfield was started during the month of June 1907, by which time the ore-reserves had been doubled. By the end of the year 1910, the reserves had been increased to 203,500,000 tons by development and through the acquisition of the Boston Consolidated Mining Co.'s property; and at the close of the year 1911, they had been further increased to 301,500,000 tons. When operations were started in 1907, the tailing from the Magna plant, owned by the Utah Copper Co., and those from the Arthur plant, then owned by the Boston Consolidated Mining Co., were discharged to the north of the mills and impounded behind small dikes, which had been built to protect the property lying to the east and the Los Angeles & Salt Lake railroad, lying to the north.

The total area of the tailing-ponds was 3000 acres, and by the end of the year 1915 the dikes around this area had been raised to an average height of 20 ft. By this time the estimate of ore-reserves had been increased to 390,000,000 tons, with a probability that much additional ore would be developed in the future. An investigation showed that in order to impound the ultimate tonnage of tailing, it would be necessary either to raise the dike around the 3000 acres to an average height of 80 ft., or move the Los Angeles & Salt Lake and the Western Pacific main tracks far enough north practically to double the area for tailing disposal. It was estimated that the cost of raising the existing dikes would be about $1,680,000, and that the cost of purchasing additional ground, moving the two railways, and building the new north dike would be about $860,000. Therefore the latter plan was adopted. One of the reasons for making this decision was the fact that if the Utah Copper company should store an enormous amount of tailing adjacent to the railway-lines for a distance of about four miles, with settling-ponds retained by dikes 50 to 100 ft. high, the impounded water and tailing would prove a continuous menace to the operation of the railways After considerable time spent in negotiations with the officials of the railroad companies, their consent was obtained to the moving of their main-line tracks.

By this plan, the lands to be used solely for impounding tailing from the concentrating plants aggregate about 6000 acres. This area was bisected in an approximately east-west direction by the main-line tracks of the Los Angeles & Salt Lake and Western Pacific railroad companies, and it was necessary to move their tracks to the north a distance varying between 1 mile and 1½ miles for a length along the main lines of about 9 miles. The scheme also necessitated moving and extending the main line of the Bingham & Garfield railway near Garfield to a new connection with the Salt Lake route. The ultimate capacity of the pond will be sufficient to handle all the tailings rejected from the Magna and Arthur plants during the life of the property insofar as it can be estimated now.

By the appended map, Fig. 1, it will be noted that the new sites of the Los Angeles & Salt Lake and Western Pacific roads are parallel to each other and 100 ft. apart. In addition to railway construction, it was necessary to build about seven miles of dike around the new tailing-pond. The contract was given to the Utah Construction Co. at a unit price of 25 cents per cubic yard for all material on the railroad construction finished to a grade-line, and at a unit price of 20 cents per cubic yard for embankment in dikes, which it was not necessary to finish to any specified grade. Because of the wet condition of the ground, drag-line excavators were used. Ditches were first constructed to the Great Salt lake in order to drain the ground as much as possible before building the embankments for the two railroads. After the railroad embankments were completed, a tailing-dike was built, borrowing the necessary material from the inside. In all this work, the drag-line machines handled an average of about 22,000 cubic yards of material per month per machine. Concrete dewatering-boxes were constructed through the tailing-dike, and the dike was

FIG. 4. SWITCH-BACK SYSTEM IN CARR FORK CANYON

riprapped on the inside with slag obtained from the slag-dump of the Garfield smelter.

Water Supply for the Plants. On account of the greatly increased tonnage, it became apparent that more water ought to be secured for milling operations; therefore, some years ago, the Utah Copper company filed on 100 cubic feet per second of the surplus water of Utah lake. In order to deliver this water to the plants, it became necessary to purchase a right-of-way through the Utah & Salt Lake canal, and to enlarge that canal from its intake at the Jordan narrows to the reservoir at the Magna plant, a distance of 27.5 miles. The work was finished on April 29, 1918. The water is delivered through the canal at an elevation of 18 ft. below the bottom of the Magna reservoir, thus effecting a large saving in the cost of power over the former method of lifting all the water 220 ft. from the lagoon at the old Magna steam-plant.

There are times during the winter season when the flow of water in the Utah & Salt Lake canal is blocked by snow and ice. In order to ensure a sufficient supply of mill-water at all times, and as a protection against unforeseen accidents, practically a duplicate water-supply was secured by the purchase of 1325 acres of land lying about 9 miles east of the plants. The topography of this land is such that it forms a natural reservoir for the drainage from higher lands; but, nevertheless, its elevation is sufficient so that the storage-water can flow by gravity to the lower pumping-plant at Magna through a canal constructed for that purpose. The position of these eastern lakes is shown on the map, Fig. 1, as well as the position of the Riter drainage canal through which the water is delivered to the pumping-plant. It is believed that the present water-supply of the Utah Copper company for milling purposes is now such as to make practically impossible any combination of circumstances that would necessitate the closing down of the mills, or even any reduction in their capacity, because of water shortage.

Mining in Idaho in 1919

During the first half of 1919 mining in Idaho, as in other Western mining States, was less active than it had been for many years. This general decline was caused by the drop in the prices of metal and the high cost of labor and material. Several of the larger producing mines, such as the Hercules and the Tamarack & Custer, were closed when the price of lead dropped from 7.1c. per lb. in 1918 to about 5c. per lb. in April 1918. When the price of zinc decreased from 9.1c. to 6.49c. it was not profitable to market zinc concentrates, and the Interstate-Callahan, the largest zinc producer, was closed in March. This mine has since been re-opened. As the smelting plants had difficulty in marketing their product they were not operated at full capacity. At the Bunker Hill smelter only one lead furnace was in blast in March, and much pig-lead was in stock awaiting shipment. The Northport lead plant, which receives concentrates from the Hercules and the Tamarack & Custer, was closed in April, but the East Helena plant (Montana) increased its shipments of bullion.

In 1918 the mines of Idaho shipped 503,437 tons of crude ore and concentrate, of which 417,155 tons came from the Coeur d'Alene district. In the first six months of 1919 the mines of this region were shipping at the rate of only about 250,000 tons per year, or at about 60% of their normal rate. In Lemhi county, which produced 11,200 tons of crude ore and concentrate in 1918, about the same average was maintained in 1919 from the Pittsburg Idaho, Latest Out, Gilmore, Sunset, and Pope Shenan properties. In Blaine county, however, the shipments fell from 6406 tons of crude ore and concentrate in 1918 to only an occasional shipment in the early part of 1919. Custer county was far below normal in its shipments of both copper ore and lead ore. The output of gold in 1918 was valued at $702,816, a large decrease. There will probably be a further decrease in 1919. Dredging is now confined to the work at Murray, in Shoshone county. The output from deep mines in Idaho county is decreasing, leaving Boise and Shoshone counties the main sources of gold. In Lemhi county, on Carmen creek, a new concentration and cyanidation plant was installed at the Big Dyke mine, the ore of which contains gold, silver, and some lead. The production of silver in 1918 was 9,172,340 oz., valued at $1 per oz. In spite of the higher price in 1919 there will probably be a decided decrease in the output, for the mines that produce lead-silver ore are making only about 60% of their normal shipments. A number of the big silver-lead mines were idle for several months. The output of copper in 1918 was 6,533,888 lb., valued at $1,613,870. The Empire Copper Co., at Mackay, the main producer, reduced shipments from about 4000 tons to 1000 tons per month in 1919. The National mine, near Mullan, was shipping about 4000 tons of copper concentrate per month, but the Richmond, at Adair, was idle.

In 1917 Idaho produced 393,559,521 lb. of lead. In 1918 the total output was 294,695,993 lb., which may be cut in half for 1919 unless conditions improve materially during the later part of the year. The Bunker Hill & Sullivan mine has maintained good production, as have the Hecla and Gold Hunter; the Morning mine has been operating on a reduced scale and several of the lead mines are curtailing production awaiting a better market. Since the first of the year the large tailing pile at Sweeney is being treated in the old Federal mill now owned by the Bunker Hill company. An article describing this in detail appeared in the 'M. & S. P.', August 30, 1919. The decrease in the production of zinc has been greater. In 1917 the mines of Idaho produced 79,854,136 lb. of recoverable zinc and in 1918 only 45,161,712 lb. With the Interstate-Callahan idle part of the year and the Success and Highland Surprise closed there is every indication of a much smaller output in 1919. Zinc concentrate is being shipped from the Morning mine of the Federal company, but the North Star property is idle.—C. N. Gerry, U. S. Geological Survey.

The Genesis of Quartz in Veins

By GEORGE J. BANCROFT

In discussing theories pertaining to the genesis of ore deposits, I have learned from experience and observation that one may set forth a hypothesis with every assurance that it is novel only to learn eventually that it is almost as old as the deposits discussed. So in writing the following, I do it simply because I, in my limited reading, do not happen to have seen these ideas discussed in print.

I have noticed several articles lately in which quartz was spoken of as having been 'deposited'. Now my observations have led me to believe that the quartz in veins is mostly residual, and that very little of it was deposited, except under the conditions hereinafter discussed. I have noticed that quartz is abundant in country-rock that contains much silica and rare in country-rock that contains little silica. Examples along this line are so numerous that I cannot believe that the matter has escaped previous discussion, and yet, as said above, it has escaped my reading.

Consider Leadville, for example. The orebodies in the pure limestone contain very little quartz, in the sandy limestone and the porphyries they contain considerable quartz, while in the quartzite they are nearly pure quartz.

At Central City, Colorado, the country-rock is pre-Cambrian schist and gneiss. Wide zones of mica-shist are recognized as unfavorable for extensive quartz lodes, while the more silicious gneiss is recognized as favorable.

At Bisbee, Arizona, there is relatively little quartz on the limestone side of the contact and relatively much quartz on the porphyry side.

The Stratton's Independence vein at Cripple Creek had a prominent quartz outcrop in the granite (silica 72%), but no outcrop at all in the andesite (silica 59%).

In the Neglected mine, in the La Plata mountains, Colorado, the vein traverses alternate beds of sandstone and porphyry. In the sandstone there is much quartz and but little ore, whereas in the less silicious porphyry, there is little quartz and there may be considerable ore. The same thing is true in the May Day mine.

Examples might be continued indefinitely, but my readers can think of them as fast as I. Broadly speaking, I think it will be admitted that orebodies in pure limestone or other non-silicious rocks are apt to be almost destitute of quartz, and that, to a certain extent, the more silicious the country-rock, the more quartzose will be the veins.

It is, however, noticeable that granite or other rocks in which the silica is partly in large quartz grains seem to run to extensive masses of quartz whereas in an equally silicious eruptive, such as rhyolite, where the silica is mostly combined in silicates or occurs in minute quartz grains, there is less likely to be extensive development of quartz. Witness the pronounced quartz veins in granite at Coolgardie, in Western Australia, at Buffalo Hump and Rocky Bar, in Idaho, and at Cornucopia, Oregon, compared to minor quartz developments in the rhyolite areas of Nevada.

In several localities where veins pass through stratified formations, I have noticed that quartz will extend upward from a silicious bed a little way into a non-silicious bed, say twenty feet or so. This indicates to me that even such quartz as may be taken into solution does not migrate very far.

From a large number of observations, of which unfortunately I have few notes, it appears to me that convincing evidence is presented showing that primary mineral solutions decompose the feldspar, mica, hornblende, etc., but disturb the pure quartz grains not at all. The silica from the decomposed silicates does not seem to travel far before it lodges or crystallizes out. The silica that comes with the solution from its ultimate source seems to be of relatively small volume, except as hereinafter discussed.

There is another feature that I have noticed and know that many others have noticed, namely, that white mica, or sericite, is the last of the original or metamorphosed rock-materials to decompose and yield its place to quartz. Furthermore, it is noticeable that quartz having a little included feldspar or mica is seldom valuable as ore. There are many exceptions to this rule, of course, but still I think it is safe to say it is a rule. Along the same line C. F. Tolman, Professor in Stanford University, tells me that many quartz veins carry their value in thin veinlets of younger quartz, encrusting the grains of the older quartz. This fact has been established by microscopic examination of a large number of specimens gathered all over the West, but particularly along the Mother Lode of California.

These two observations suggest that in many veins the major quartz development takes place prior to the metal enrichment and that metal enrichment is often attendant upon a re-opening of a quartz vein; in other words, the important action from an economic standpoint is the last action of all, and is accompanied by the elimination of the last traces of mica and feldspar from the quartz. I believe that J. F. Kemp, Professor in Columbia University, has called attention to the fact that metal enrichment was often the last act of the series that produced orebodies, but he reached these conclusions from the study of other phenomena than those herewith presented.

If then my observations are correct, the solutions or gases that form orebodies are such as do not carry and have not dissolved silica to any great extent, and that

either do not carry metal values until the latter part of their cycle of operations or do not encounter conditions favorable for precipitation of metals until the latter part of their cycle of operations. It is apparent, of course, that these observations, even if entirely free from error, do not take us much nearer the solution of the problem of the genesis of ore deposits; at most, they may give us a new angle of insight and by the slow accumulation of such new observations we may eventually learn what the chemical nature of mineralizing solutions really is, and what chemical, electro-chemical, or thermo-chemical reactions take place in the process of ore genesis.

In referring to white mica, it is recognized, of course, that the original crystals may have been biotite or some other silicate and that one of the first actions of the mineralizers may have been that of sericitization or propylitization, either of which, as I understand them, involves the removal or pyritization of the iron of the biotite and the re-crystalizing of the mica in a white and somewhat aqueous mica form, which may be sericite, margarodite, hydrophilite, damourite, or sterlingite.

In suggesting that quartz is mostly of local origin, I refer to orebodies that have been effected by migrating solutions or mineralizers. Orebodies formed by the process now recognized under the term 'magmatic segregation' contain much quartz that evidently is not 'residual'. It has been 'deposited', if I may misuse that term. At any rate, the quartz has evidently assembled from somewhere. One often finds, in orebodies of magmatic segregation, enormous masses of very silicious ore in a magma that is very low in silica.

L. D. Ricketts, in a personal letter, has called my attention to this fact and pointed out that the silicification sometimes extends beyond the magma into adjacent country-rock. He says: "For instance, in Cananea there is a contact between limestones that were once quite pure and eruptive rocks. These limestones have become highly silicified and converted into basic garnets that smelt nicely, and while they carry an excess of iron and alumina, they also contain from 20 to 30% of silica. At Puertecitos, I do not know what the original limestones were like, but the ore deposits there are of highly silicified limestone that contain an excess of silica over lime and iron."

It may be that the process of magmatic segregation is not distinctly different from the process involved in vein enrichment. We can conceive, for instance, of an emigration of mineralizers from and through a molten magma, which mineralizers discharged minerals en route according to varying degrees of pressure, temperature, and other conditions. In the immediate vicinity of the magma, where we may assume the temperature and pressure were high, there was considerable ability to move silica, but as temperature and pressure lessened this ability was lost.

After all, the ease of making and re-making theories of ore genesis only serves to emphasize the conclusion that we are hedged about with relatively few facts. The important thing to keep in view seems to be the perfectly enormous void of that which we do not know, rather than the little amount that we do know; but it is also important to keep adding to this little amount every fact which it is possible to gather. It is in this spirit that I offer the above.

Until 1917 the only manganese deposits in South Africa to which any attention had been paid were contained in certain fissure veins in the Cape Province and in the Transvaal. During the past two years more attention has been given to the deposits of this ore, and from investigations it was ascertained that manganese ores exist in the Union in three main classes of deposits, namely: (*a*) Fissure veins and lateroid enrichments on the outcrop of such veins; (*b*) connected with the dolomites and Moodies series; (*c*) lateroidal deposits derived from dolomites. The most important deposits of manganese ore are the lateroidal deposits associated with the dolomite in the Krugersdorp district in the Transvaal. The ore in this district occurs chiefly as dioxide in the form of pyrolusite or psilomelane, and is evidently a replacement mineral. The workings cover an area of about three-quarters of a mile by half a mile, and consist of shallow pits sunk at intervals of a few feet, placed in more or less regular lines throughout the area. The areas in the Transvaal and Bechuanaland, where the dolomites lie almost horizontally and have suffered from intense denudation, are said to be extensive. Part of the manganese ore produced has been used in the cyanide works of the Rand gold mines, but with the development of an iron-smelting industry in the Union the local demand for manganese ores will be stimulated.

Electrolytic precipitation of gold and silver from cyanide solutions would seem, on the face of it, not to offer any great difficulty, since the electro-plating of gold and silver is a well-developed art. But, as a matter of fact, a great many practical difficulties develop, because the solutions resulting from the cyanide treatment of ores are a rather complex mixture of salts, and no really satisfactory substance has been found for the insoluble anode that must be used. The precipitation of these metals by the use of zinc shavings or dust is so relatively simple that their electro-deposition has never come into general use, although a patent for such a process was issued twenty years before the McArthur and Forrest patent on the cyanide process of gold recovery appeared. Nevertheless, a number of processes for this purpose have been patented. At intervals over a period of twenty years Prof. Christy studied the problem, taking out a patent for a process of his own in 1900. Like the other patented processes it never came into general use, but in the course of his investigations Prof. Christy performed an enormous amount of experimental work, which is recorded in a monograph. This careful record of experiments covering all phases of the subject under investigation is of great value for reference for investigators in the field of electrolytic deposition of metals, and can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., for twenty-five cents.

REVIEW OF MINING

ARIZONA

DOUGLAS, BISBEE, TOMBSTONE, COURTLAND, MIDDLEMARCH

DOUGLAS.—The movement of copper stored at the Copper Queen smelter since last winter has begun and it is now going to the Eastern refiners at the rate of two carloads daily. This is the most encouraging sign, locally, of betterment in the copper situation. There is nothing to indicate that smelter production will show an increase in September over the August production.

BISBEE.—What promises to be one of the biggest discoveries in the Warren mining district was made recently in the Night Hawk mine on Phelps Dodge property, operated under lease by the Night Hawk Leasing company. At last reports the 650-ft. drift was in a full face of ore carrying cuprite and chalcocite in large streaks that will average better than 50%, while the main body assays approximately 10%. The ore is of the same character, although showing some enrichment, as that encountered on the 450-ft. level and followed down from that level in a winze. The orebody was encountered 160 ft. from the shaft on the 650-ft. level. If development bears out indications this will be one of the largest, if not the largest body of high-grade ore ever found in this district. The Night Hawk lease still has four and a half years to run. James Z. McKenna is superintendent of the property.

Adjoining the Night Hawk is the Boras lease, which is starting a drift on the 400-ft. level to test a body of copper ore, much of which runs as high as 40%, which was struck recently on the 300-ft. level. Some high-grade silicates, carrying a high gold and silver tenor, also was encountered on the 300-ft. level. Five carloads of this ore have been shipped from the pocket. The main shaft of the property has just been sunk 100 ft. from the 300-ft. to the 400-ft. level, by J. A. Roper, under contract. Mr. Roper made something of a record for this district, putting the shaft down the 100 ft. in 19 days. His contract price was $25 per ft. The Boras has been working for two years. It has but 18 stockholders, all Bisbee men. At the head of the company is E. A. Tovrea as president, while L. R. Bailey, postmaster of Bisbee, is vice-president, and John J. Bowen, secretary-treasurer. N. J. Elsing, a mining engineer who recently became interested in the property, is directing operations. Considerable ore has been shipped to the Copper Queen smelter at Douglas during the life of the property and it has been announced that shipments will be resumed in the near future.

In the same district the White Tailed Deer mine of the Phelps Dodge Corporation, and the Wolverine-Arizona company are reported to be developing good orebodies. Lieut. Col. John C. Greenway, who recently resumed his position as general manager of the Calumet & Arizona and New Cornelia properties, has received the Cross of the Legion of Honor, awarded him by the French government for valor. Colonel Greenway went to France as a major of engineers, but later was transferred to the 101st infantry with which he fought at St. Mihiel and in the Argonne. In the latter engagement he was severely gassed and, since his return to Arizona last spring, he has been recuperating, only recently regaining his health sufficiently to resume his duties with the companies he represents.

TOMBSTONE.—August was a record-breaking month with the lessees operating here, as more than 80 carloads, mostly silver ore, was shipped to the smelters. This exceeds the records of the last fifteen years, according to J. N. Gaines, secretary for the the Cochise County Taxpayers Association. Indications point to September witnessing an even greater output from Tombstone properties. Practically all of this ore will come from leases, as the number of men working on 'company time' in the Phelps Dodge holdings is relatively small. Some time ago it was reported that the Phelps Dodge people were to re-open their mines here on a large scale, but inquiry developed the falsity of this rumor. However, so many leases have been acquired from the Phelps Dodge interest that the effect is much the same as though the company itself was at work. The old camp is being rejuvenated rapidly. Another camp which is showing signs of activity after several decades of slumber is Charleston, the first boom silver town and smelter city of Cochise county. Several properties carrying silver ore in quantity are being worked in a small way. With a silver market above one dollar, it is not hard to predict a general reopening of old mines forgotten since the early '90's when silver slumped so badly.

COURTLAND.—Mining activity is increasing here and about 60 men now are employed in the camp, including employees of the Great Western Mining Co. and leases on ground belonging to the Leadville company. Some of the lessees are said to be doing exceptionally well. Approximately two carloads of ore are sent from here daily to the C. & A. smelter at Douglas. The Great Western is making regular shipments from a surface shaft at a point where ore was encountered two years ago in diamond-drilling work. Machinery has been installed for the purpose of sinking a three-compartment shaft in order to develop this orebody, which appears to be a large one.

MIDDLEMARCH.—The Middlemarch copper mine has been forced to suspend operations, pending repairs to

machinery, damaged by alleged sabotage growing out of a strike. Approximately five weeks ago the miners went on strike after the company had refused to meet their demands. A few days ago officials of the company attempted to start up the machinery only to find that bearings and other delicate adjustments had been treated with a liberal application of carborundum and badly damaged. Blame for this is attached by company officials to transients who were working at the mine at the time the strike began and no suspicion attaches to the main body of the men, many of whom have been with the company over a long period of years.

CALIFORNIA

NEVADA COUNTY, GRASS VALLEY, SIERRA COUNTY.

NEVADA COUNTY.—The Champion Mining Co. has petitioned the Railroad Commission for a reduction of its water rate paid to the Excelsior Water & Mining Co., the basis of the petition arising from the fact that the water is returned to the ditch and again sold for irrigation. The mine is paying nearly $400 per month for water power. John Bath, a prospector, has taken a bond on the Ross ranch at Newtown, where he recently made a discovery of a vein from 12 to 15 inches wide showing visible gold. An important discovery has been made in a raise from a tunnel on the Crackerjack quartz mine at the head of New York canyon in the Moore Flat region. Some of the quartz contains visible gold in spectacular quantities. The mine is owned by the Buck brothers of Orleans Flat. A small crew has been at work on the South Star quartz mine all summer with encouraging prospects. The Dulmaine-Normandie property has been taken over by a Los Angeles company and development work has been in progress a short time.

The Delhi mine near Columbia was sold by the sheriff to satisfy a judgment of $39,289 and was purchased by Louis Nonnenmann of San Francisco for $20,000, he being the only bidder. The Delhi has been a producer but for a few years has been entirely idle. A. A. Codd of Reno, Nevada, has a bond on it and adjoining properties incorporated under the title of the St. Gothard Gold Mining Co., but whether the latter company proposes to rehabilitate the old Delhi is not known.

GRASS VALLEY.—In the case of the Golden Center Mining Co. v. the City of Grass Valley, the statement has been made that the city did not desire to obtain the mineral rights of the mining company, but merely wished to protect the townsite patent. It is stated that this is only an excuse that has no foundation in law, and that the real reason for the suit is the opposition of some influential residents of the city who object to mining operations encroaching upon the residential districts. It is also feared that in case of a final decision in favor of the mining company other locations would be made on mineral lands within the city limits. The mining companies generally are operating on the outskirts of the original townsite, but many of the veins are believed to extend under the city with depth.

SIERRA COUNTY.—Hugh McCormick is at work on the old Arizona tunnel, at the head of Jim Crow canyon. The tunnel was driven years ago, but gravel was never uncovered. The present intention is to put up a raise much nearer the entrance on the theory that the tunnel and old raises are beyond the channel.

COLORADO

CRIPPLE CREEK, LEADVILLE, LA PLATA, OURAY.

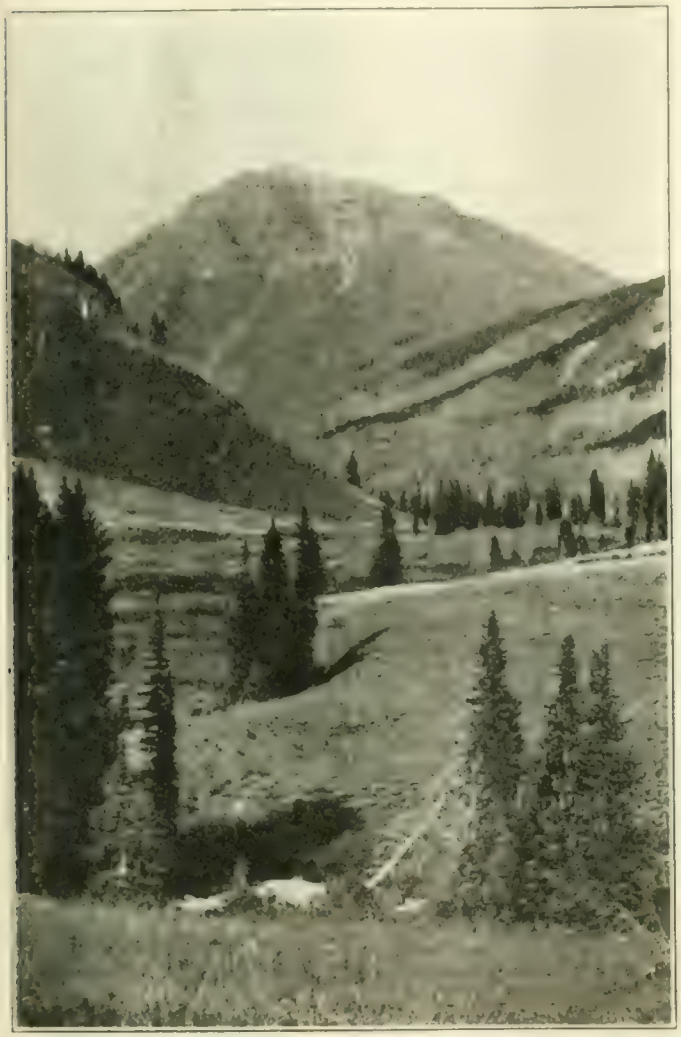
CRIPPLE CREEK.—Sinking has been resumed by the Acacia company at the South Burns shaft, on Bull hill, and will be continued to a depth of 1150 ft. A milling grade of ore is under development in the 1450-ft. level and shipments are moving to the Golden Cycle company's plant at Colorado Springs. A rich gold discovery has been made by F. M. Kurie, former superintendent of the Portland company, now operating on the Bull Hill group of the Stratton estate, under lease. Working through the Star of Bethlehem shaft Kurie has cut into a rich shoot at the junction of the Eagles and Shurtloff veins at a depth of 150 ft. from surface. The Hoosier mine on Tenderfoot hill, owned by the Grafton Gold Mining Co., is under examination for Grant Robinson of Denver and associates holding an option to lease. The Hoosier has produced in the neighborhood of $500,000 gross, but has lain idle a long time.

Cresson stockholders have been advised that regular monthly dividend payments will for the present be discontinued and payments made only as financial conditions permit. The Caley mill on the Jerry Johnson property on Ironclad hill is being dismantled. The plant at no time operated at a profit and the machinery has been sold to the Morse Bros. Machinery company of Denver. The Portland company reports another rich discovery south of No. 2 shaft in Independence territory at a depth of 2100 ft. The shoot has not been developed sufficiently to determine its extent.

LEADVILLE.—Sam Doran and associates, operating the Hill-top on the Summit of Mosquito pass, have opened and are now developing a large orebody carrying silver and lead. The ore has been cross-cut by adit for 150 ft. and by raise, the ore continuing in each direction, vertically and laterally, as far as the exploration has advanced. The old aerial tram on the property is now being overhauled and the railroad spur running into Levick, the shipping point, is under repair, and shipments will commence as soon as cars can be sent in. It is estimated that 100 men can be put to work on the orebody as soon as stoping is ordered. The discovery is pronounced the most important in the Leadville district since the discovery of the lead-silver orebodies on the Mikado and Penrose mines. The Bull's Eye lease on the property of the Silver Mountain Mining Co., operated by Alfred Swanson and associates, is again mining silver-iron ore. A contract has been secured for delivery of 500 tons to the Pueblo smelter. The Shamus O'Brien on Yankee hill, a zinc producer, and the Seneca lease in the same region are again operating. Electric hoisting plants have been installed on both properties and extensive development planned. New machinery is under installa-

tion in the Leadville District mill, W. S. Brooks, manager. The mill will treat the low grade sulphide ores of the district by a new process.

La Plata.—A large amount of development is under way, and the balance of the present season will probably be spent in getting the various properties of the district into shipping condition next year. Geo. W. Gilmore &



A GLIMPSE OF THE SAN JUAN

Co. are developing the Jumbo extensively and have shipped several cars of ore. Most of the value of the ore is in gold and silver, with occasionally some lead. Heavy production is expected upon completion of driving operations this fall. Although work on the Jumbo is on the larger scale, work on the Idaho and the Idaho dump is being carried on. The dump is under lease to Brandiger & Hobson. Hutchinson & Co. have leased the Southern Boy lode to Costly & Akins, who have opened a pocket of high-grade ore, which brought returns of $200 per ton when packed to the smelter. A company of Kansas men is becoming interested in the Puzzle Group, and the property will probably be developed with a view to shipping the ore in quantity. The Lewis Mountain M. & M. Co. continues to develop the Ten Broeck, and the property is being rapidly put into condition as a producer. The 2800-ft. adit, which has been under way for the past three years, is nearing completion, cutting the vein system of the Ten Broeck in such a way as to permit extensive operations. The Lewis Mountain M. & M. Co. has attained greater depths than ever before attained in the La Platas, 2200 ft., at a great expenditure of money, but returns seem assured, as the ore is reported to assay $60 per ton. Blunt and partners are operating the Little Nona under lease, and the driving of a 60-ft. tunnel is almost completed, cutting the vein at the Jumbo-Nona intersection. Minoletti & Co. are working the Mountain Meadow and other properties of P. W. Pittman at the head of Junction creek. The Tomahawk mine, owned by T. J. Kelley, has been leased to a company of local men, who are developing the property and shipping ore. The Small Hope is under lease to local interests, who are shipping ore. The Little La Plata, owned by the estate of Wahl Bros., is under lease to Little & Carigan, who are working over the dump, and shipping ore. Basil Caramouziz has leased the Eagle Pass Mining Co. holdings and is shipping ore.

Cave Basin.—Yingling and partners continue to open up the Excelsior claim. A new company has been organized to develop the Colorado group, where good assays in silver and copper are reported. The property covers 240 acres of land in a lime formation. The ore will be hauled 25 miles to the Durango smelter. The road is good to within 2½ miles of the property, and this distance will be bridged at an early date.

Ouray.—The Chipeta Mining, Milling & Smelting Co., organized in June 1918, is now fully capitalized. The principal work of the new company will be operating the Bachelor Khedive, but a number of construction jobs are necessary before mining will be undertaken. A building will be put up to house the motor, compressor, and hoist, and a small house for a gas-engine. Driving along the Khedive vein to a point in the Old Maid shaft, a drive of 500 ft. to cut the Oak Street vein will then be started. As a convenience to the miners, pay day will be established twice a month, on the 5th and 20th. A large surface body of heavy lead ore was discovered on the Toledo group, running for 600 ft., and 3 ft. wide, carrying from 40 to 53% in lead, with 10 to 20 oz. in silver. A strongly capitalized company has been organized to open the property and a mill is under consideration. The various mines of the districts are showing more activity than for the past three years, and the developments under way augur well for a busy and prosperous season during 1920. A deal that has been pending for several years was consummated when the American Smelting & Refining Co. took over the Revenue mine under a bond and lease by which $100,000 is to be expended during the next 18 months on developing the old producer. The fact that such a large investment is contemplated by the A. S. & R. Co. has reassured the mining interests of the district. The Calliope dumps are being worked over by Jesse Steel, under a lease from the Nix interests. The run of ore is generally good, carrying 12 oz. in silver and two cars have already been shipped to the smelter at Durango. The Camp Bird tax case is interesting to mining people generally, as it sets a prece-

suit for taxation of idle properties. The Camp Bird company contested the assessment on the valuation of $400 per acre applied by the county assessor, and suit was brought before the District Court, and the case was heard before Judge T. J. Black, sitting at Montrose. A verdict was returned favoring the Camp Bird, the assessed valuation being placed at $21 per acre, which was the valuation of the Barstow property, the nearest non-producing mine. Upon further discussion, the county and the Camp Bird agreed upon a valuation of $60 per acre, and the case will not be appealed. The raise to provide better ventilation is nearly completed, and mining and milling may be resumed about October 1.

Red Mountain.—There is noticeable activity in the district, the recent discovery at the Barstow having given added incentive to the development operations now under way. The railroad is in poor condition from the Joker tunnel to Genesee, so that much of the ore has to be hauled for a few miles to make rail connections. A number of old producers are being reopened, including the Robert Bonner mine, near Burro Bridge, where good orebodies are reported, and the Radiant Mining Co., which is opening the old Ruby group of claims, and now shipping in small quantities. Mill construction now under way affords an added indication of future prosperity for the district. The Tom Crawford mill at Ironton is nearly completed. The Summit company has approved plans for a new mill near the portal of Koehler tunnel, providing for ten stamps, table concentration, and flotation units. The capacity will be 100 tons. The construction work is under Charles McMillen, and will be started as soon as the railroad is serviceable. A short stretch of road will be constructed from the mill to Sheridan Junction on the Red Mountain branch of the railroad. There will not be any heavy production during the present year, but the outlook for the ensuing year is favorable. The Boston company has leased its property at Ironton to Canavan & Co., who are starting operations by repairing the tunnel for a distance of 65 ft. After the tunnel is in proper condition, there will be a drift for 250 ft. on each side of the intersection of the vein. The cross-cut will be continued for a distance of 150 ft. in order to cut the main lode.

The Barstow operations under Lundberg & Curtis, lessees, continue to show favorable returns. A short run of low-grade ore followed the recent discovery, and then a vein of high-grade ore was encountered. The vein is from 1 to 3 ft. wide, continuing for a distance of 35 ft. The recent discovery of high-grade made up four cars of ore shipped to the smelter at Durango, and is reported to have brought the fortunate operators net returns of approximately $7000 per car. The Ouray Consolidated company has opened some fine orebodies on the Guadaloupe, and continuous running during the winter months is expected. A new bunk house is under construction, dimensions 18 by 51 ft., and is to be completed this fall. The Guadaloupe is to be connected to the Tom Crawford mill by a two-bucket tram, 3500 ft. in length, permitting the moving of the ore from the working tunnel to the mill at a low cost. The most interesting development in the district is the recent survey of the entire workings of the Red Mountain Mines Co. holdings by the Smuggler Union Mining Co., which has had a corps of expert engineers and geologists making an exhaustive examination of the property with a view to development. Should their opinion be favorable to purchasing, there is no doubt that the Red Mountain district will assume its old place as one of the leading producers in Colorado. The Yankee Girl workings were unwatered this season, permitting an examination of the deep orebodies. The machinery of the Guston mine has been sold to the Sackett foundry of Telluride. Much of the machinery is in excellent condition, notwithstanding long disuse and exposure. Some equipment will have to be recovered from the lower workings, and will be removed with great difficulty. Operations on the Congress mine have been resumed by King, Lovingood & Co. Giono & Co. are again shipping from the Congress dumps. P. Walker has resumed operations on the Kansas City mine, and will probably ship a few cars this season. E. W. Creel will reopen the Wyoming mine, having some fine zinc orebodies in sight and a good showing of high-grade silver ore.

NEVADA

STRIKE AT TONOPAH NOT SETTLED.—GENERAL NEWS.

Goldfield.—In a drift 425 ft. south from the shaft the Red Hill Florence has opened ore. No statement has been made by the management regarding the find and it is probably what would be regarded as unimportant if made elsewhere in the district. The face of this drift is far south of the Florence fault, beyond which ore has never been found except in small lenses, and the discovery of an orebody would result in the re-opening of the entire southern part of the district, which has been inactive for many years. It is planned to continue the drift for a total distance of 800 ft. to reach under a group of red hills from which the company takes its name. This drift, on the 500-ft. level, was driven 250 ft. by a former management. The Red Hill has secured by lease a narrow strip along the western side-line of the Florence and a drift is being driven south in this ground to prospect numerous small seams. The Florence Divide lease on the Florence Goldfield has sacked 1000 lb. of ore estimated to be worth $7 per pound from the newly discovered hanging-wall seam. The last carload of ore shipped was estimated by the Florence company to be worth $365 per ton. This was the nineteenth carload shipped from the lease since it was taken over by the Florence Divide. The eighteenth assayed $134 per ton. The west cross-cut being driven by the Florence company is 180 ft. long. Seams assaying from 80c. to $2 are being cut. A carload of ore assaying from $40 to $50 is being loaded by the Delcic lease on the old Wheeler block.

Tonopah and Divide.—After apparently having brought the Tonopah-Divide strike to an end by securing a 6 to 1 vote for the workers to resume, Governor Boyle has left Tonopah, with conditions, according to general

option, in almost a hopeless state. After the vote had been taken it was found that practically none of the underground men had cast ballots and the mines were unable to reopen. The governor is now in San Francisco and will return to Tonopah in a few days to reopen negotiations, which are being conducted between the State and the workers, the operators having withdrawn their representatives.

A drift from the bottom of a 60-ft. shaft on the West Divide has penetrated 36 ft. of silver ore. For the first 18 ft. from the shaft the shoot is from a few inches to 2½ ft. wide and assays 100 oz. The second 18 ft. is from 2½ to 3½ ft. wide and assays 75 oz. With this ore is a seam from 1 to 3 in. wide that assays from 1000 to 1500 ounces.

Tonopah men are becoming interested in the Birch creek gold discovery, 10 miles south-east of Austin and in Smoky valley. According to men who have been to Birch creek, the vein in which the original discovery was made by John Cahill has been cross-cut for 50 ft., narrow seams of ore assaying from $10,000 to $50,000 being exposed in rhyolite. The foot-wall of the vein is lime and the hanging wall is monzonite. The district has been named Telluride.

Pioche.—The shaft of the Prince Consolidated at Pioche, now 400 ft. deep, is to be sunk an additional 500 ft. to open an orebody discovered in drilling and may be sunk to 1300 ft. to open a second vein found in drilling. New surface equipment for the work has been ordered. The drill penetrated the first vein for 10 ft. and the second for 11 ft. The first contained 25 oz. silver and $3 in gold. The second contained 30% zinc. The Prince is shipping 2000 tons of lead-silver ore to the Salt Lake smelters weekly.

Rochester.—The Rochester Nevada, the Nevada Packard, and the Mill City tungsten mines and mills are closed because of a shortage of water in the canals at Lahontan. The Nevada Valleys Power Co., supplying the mines with electric power, has a generating plant on the canal, from which the ranchers at Fernley are drawing heavily for irrigation purposes. The Western Ore Purchasing Co. sampler at Hazen is operating entirely at night, when the power requirements of the farming districts are light.

Eureka.—Veins of ore containing 20% copper have been found in the bottom of the 250-ft. winze from the 400-ft. level of the Croesus-Eureka, far above the water-level. The winze orebody, opened at 200 ft., is 25 ft. wide at 250 ft. and the average content for this width is 0.4 oz. gold, 20% copper, 110 oz. silver, and 75% lead. This work is being done 1000 ft. south of the early-day workings and in territory heretofore unexplored. North of the winze on the 400-ft. level a drift from the east cross-cut at this point has exposed a full face of ore that assays 0.2 oz. gold, 100 oz. silver, and 70% lead. New and more powerful surface machinery, including a 12-drill compressor, is being erected. Ore shipments are being made at a rate of 60 tons per day. Adjoining the Croesus-Eureka on the south is the Peerless, under the same management, in which a large body of ore assaying from $25 to $30 per ton has been opened on the 200-ft. level. Shoots of rich ore, some assaying as high as $4000 per ton, have been found in a winze sunk from this level. Shipments of high-grade ore are soon to be started from the 400-ft. level.

THE TONOPAH DIVIDE MINE

WISCONSIN

PLATTEVILLE, CUBA CITY, AND LINDEN.

Platteville.—The Vinegar Hill Zinc Co. is engaged in an extensive exploration program in Lafayette county. Drill squads have obtained encouraging results on the Coulthard tract, east of the Crawhall and Thompson mines, profitably operated for years by the Fields Mining & Milling Co. The log warrants the early development of another zinc-ore producer. Drills at work for the same company on the Buxton-Sherry-Pedelty tracts east

of the Patsy Drumm mine, at Leadmine, have obtained satisfactory results. Shaft-sinking is well along at Copeland, near Shullsburg. Extensive exploration work has been well started on the Wm. Fields land at New Diggings. The Wisconsin Zinc Co., subsidiary of the American Zinc & Lead Smelting Co., in addition to a vigorous production campaign for its mines in this field, is extensively engaged with drill squads on the David Booty tract, adjoining the Winskill mine, a one-time heavy producer of medium-grade zinc concentrate. Results to date invite early shaft development. The Edge farm, of 600 acres, at New Diggings, and the Bushnell farm, east of the city of Platteville, have been secured and exploration by drilling will be started without delay.

Cuba City.—The Big Bend Mining Co. has been incorporated with a capital of 60,000 shares, at a par value of $1 per share. The new company owns valuable leaseholds on mineral ranges in this district, which it is proposed to prove by drilling before mine development is undertaken. The Zinc Hill Mining Co., operating the Big Dick mine, began milling with a new 300-ton concentrator September 1. A deposit of low-grade zinc-ore has been proved by drilling. Shipments of both zinc ore and lead ore have been made and the mine gives promise of heavy yield. Charles Wolf, president and general manager of the Zinc Hill, offered $50,000 for 70 acres of land contiguous to the mine-site, on which it is proposed to erect a large electro-static zinc-ore separating plant. The offices of the Zinc Hill Mining Co. are at Platteville. Thorne, Fox, and others, local mining men, have obtained the mining rights to the Pacquette leasehold, in Shullsburg township, and a new concentrator is being rushed to completion. The ground has been proved by drilling and a shaft has been sunk to ore. H. S. Snow, general traffic manager of the American Zinc Co., inspected the mining properties of the Wisconsin Zinc Co. at New Diggings the early part of this month. Mr. Snow was formerly general manager of the Wisconsin Zinc Co. in the Wisconsin field.

Linden.—David MacKay and other Milwaukee capitalists have purchased the mining equipment and mining rights of the Ross Bros. Mining Co. Ross Bros. have mined successfully for 12 years and now retire from further active connection with their mining lands. Some discoveries have been made by drilling on the Jeffrey tract, east of the old Ross mine. The Ross mill will be transferred to the new mine-site. A new 150-ton zinc mill is being built on the Optimo mine No. 4. The Biddick mine will be opened again on September 22. It is a low-grade zinc producer. The Vinegar Hill Zinc Co. has a new 200-ton mill ready for service on the Dale mine at Livingston. Three distinct ranges have been drilled, two of which converge at the Yewdall plant owned and operated by this company. To the west of the Yewdall mine and mill a new shaft is in ore at 140 ft., a quarter of a mile distant. A surface tramway is being installed and the ore will be milled at the Yewdall. The ranges as now proved extend east and west a distance of one mile. The two mills, it is stated, will yield a daily output of 100 tons of 30% zinc concentrate. Dr. Charles Ross, owner of the Ross farm of 370 acres, has expended $15,000 for exploration work on his land on what is known as Crow Branch, south-west of Livingston, and declared by State geologists to afford one of the most inviting zinc-bearing areas in the field. A shaft is down over 100 ft., bottomed at 130 ft. to connect with the ore-level.

BRITISH COLUMBIA

ALICE ARM, NELSON, SALMON RIVER.

Alice Arm.—The Taylor Engineering Co. is planning the erection of a 3000-ton ore-bunker at the wharf at Alice Arm to facilitate shipping. The railway is transporting 150 tons of ore per day from the Dolly Varden mines to tidewater. The Sweetwater claim, across the river from the Dolly Varden, has been purchased by D. J. Hancock, who is interested in a number of other claims in the district. Mr. Hancock recently announced that all right, title, and interest in the United Metals Co. had been sold to him for $25,000 and that the only interest the stockholders have remaining is the division of such moneys as has been and is to be paid by him on the property. The La Rose mine is taking out some good silver ore, two shipments having been made, one to Anyox and the other to the Trail smelter. Samples taken from the Climax claim are reported to have assayed high in silver, while rich ore of the same character is said to have been taken from the North Star mine.

Nelson.—With further reference to the Eureka mine it is announced by H. H. Vincent, president of the Vincent Development Co., which is handling the development of the combined Eureka-Granite-Poorman property for the Inland Mining Co., that the surveying of the 6000-ft. extension of the tramway has been completed and that a contract for its construction will be awarded immediately. Mr. Vincent has inspected the work at the mines recently and reports that a car of concentrate is ready for shipment to the Trail smelter. He says that it is much cleaner and better than that shipped in August, owing to the tuning-up of the Granite-Poorman mill and to other improvements effected in the interval.

Salmon River.—The discoveries of rich silver ore have attracted a number of prospectors to the Salmon River district this summer, and a considerable quantity of fresh ground has been staked. Some good silver ore has been found on the Nass River side of the divide and several locations have been made there. A considerable amount of fresh ground has been staked, too, north of the Yellowstone group. Patrick McBride and A. W. Balzimar have found some excellent ore across the glacier from the Big Missouri and have staked claims there, and other prospectors are working in the same neighborhood. Some exceedingly rich ore, showing a quantity of wire silver, has been struck on the Spider group. Patrick Daly, who is in charge of the development, estimated that $10,000 worth of ore was blown out in three rounds of shots. This property was bonded in the spring for $30,000 by R. W. Martin, who turned the bond over to R. Wood president of the Premier mine. R. Hanley, who is in charge of the diamond-drill operations at the Big Mis-

sourt, is working three shifts, and is driving about 50 ft. of ground per day. The Premier is preparing for a big shipment of ore during the coming winter, the returns from which, it is said, are likely to cause a mild sensation.

The Granby Consolidated company has been successful in its appeal to the Privy Council regarding the Cranberry district coal rights, on which its Cassidy collieries are situated. The case was brought by Bing Kee, a Chinaman, who had purchased the surface rights from the Ganner estate in 1905, and claimed that he purchased the coal rights at the same time. The Ganner trustees, on the other hand, claim that they applied for and obtained the coal rights after they had sold the surface rights to Kee; they subsequently sold the coal rights to the Granby company for $45,000. There is a case pending before the Privy Council in which the Esquimault & Nanaimo Railway Co. claim that these same coal

HYDRAULICKING IN BRITISH COLUMBIA

areas were granted to it, as part of its subsidy for building the line, by the Dominion government, and therefore the Provincial government had no right to grant the claims to the Ganner estate. The Granby company has developed the colliery and is turning out about 10,000 tons of coal per month, part of which is sold and part goes to the Anyox by-product coke ovens for use at the smelter.

STEWART.—Preston Locke, a mining engineer representing the American Smelting & Refining Co. at Tacoma, recently visited the Portland Canal and Salmon River districts. Mr. Locke was favorably impressed with the development in progress. He said that the Premier and the Joker already were mines and there were many good prospects.

TRAIL.—Ore receipts in gross tons for the week from September 1 to September 7, inclusive, at the smelter of the Consolidated Mining & Smelting Co., totaled 6610 tons, making the total tonnage handled to date this year 241,148. The largest independent shipper again was the Mandy, Le Pas, Manitoba, with 571 tons, while the Quilp, of Washington, was a close second with 442 tons. The company's mines, of course, were heavy shippers. From the Centre Star, Rossland, came 1687 tons and from the Sullivan, Kimberley, 2720 tons. The Sullivan mine has passed the 100,000 mark for zinc-ore shipments for the current year. During this period the same mine has contributed a considerable tonnage of lead ore. A new shipper is the Silverite, of Alamo, recently taken over by Clarence Cunningham.

VANCOUVER.—A representative collection of the ores of British Columbia was shown at the Vancouver Exhibition, which took place from the 8th to the 13th of September inclusive. There were attractive samples of silver, gold, copper, zinc, magnetite, wolframite, scheelite, cinnabar, bismuth, molybdenite, etc., displayed, the whole having been assembled under the supervision of the British Columbia Chamber of Mines. The exhibit from the Kootenays, prepared by Fred A. Starkey of Nelson, was one of the most prominent. It was a first-class index of the mineral wealth of that part of the Province. The lode properties of Sheep Creek, which are being extensively developed at present, were represented by specimens which attracted much attention. There were special exhibits also from the Surf Inlet mine; the Dolly Varden mine; the Britannia Mining Co.'s properties; the Granby Consolidated Mining & Smelting Co.'s mine at Anyox and elsewhere; the Canadian Consolidated Mining & Smelting Co.'s properties; the Drum Lummon; and the Bear River, Salmon River, and Portland Canal gold, silver, and copper countries.

ONTARIO

COBALT, PORCUPINE, AND OTHER DISTRICTS.

COBALT.—Following the settlement of the strike by the acceptance by the miners of the terms proposed by the mine managers, operations were speedily resumed at most of the mines. In many cases it was necessary to de-water the lower levels which had been flooded. In a few days the Coniagas and Trethewey mines were working at capacity, while the Kerr Lake, Crown Reserve, McKinley-Darragh, and some others had started operations on the upper workings. As many of the strikers had left the district the working forces of some companies have been considerably reduced, but this is likely to be only temporary as men are coming in rapidly. It is anticipated that conditions will be nearly normal by the end of September.——The Peterson Lake has made arrangements for the treatment of 1000 tons of tailing in the mill of the Dominion Reduction Co., in order to determine the silver content and the silver recovery. The company has about 250,000 tons of this tailing. Owing to the high price of silver plans are being made for the re-opening of several old properties which have been closed for some years.

PORCUPINE.—The profits of operations at the Dome Mines are understood to be about $250,000 per month, the mill-heads averaging $9.80 per ton. As this is a much higher figure than the estimated average grade of the ore-reserves, which is $5.10 per ton, the directors consider it unwise to issue official monthly statements, which might be misleading, in view of the fact that their policy

is gradually to reduce the grade of the ore treated as the milling capacity is increased. The shareholders of the Dome Lake have ratified a by-law providing for the issue of bonds to the amount of $100,000 to raise funds for development.—At the Keora a shaft will be sunk to the high-grade orebody encountered in diamond-drilling. The Porcupine Crown has been completely dewatered and ore is being developed on the lower levels. The McIntyre, which has been taking ore of good grade from the Plenaurum property, has encountered a heavy flow of water on the 1000-ft. level which is handicapping operations. The Hollinger is making efforts to increase its staff by 500 men, but has met with but little success.

KIRKLAND LAKE.—At last accounts the strike was still on at this camp, though mine managers were endeavoring to effect a settlement. It is stated that unless an understanding is speedily arrived at the mines will remain closed until spring. When the strike occurred three mills were producing: the Lake Shore, Kirkland Lake, and Teck-Hughes. The Tough Oakes mill was to have been started this fall and the Wright Hargreaves had begun the construction of a 150-ton mill. Another mill was planned for the Ontario Kirkland. Since the strike began work has been confined to a few small prospects.

BOSTON CREEK.—This goldfield is being extended by new discoveries in Boston and Catherine townships, finds recently made in the latter being farther to the south than where gold was supposed to occur. A number of claims in this neighborhood, which were allowed to lapse, have been re-staked. The introduction of electric power, which is being brought in for the Miller Independence, is expected to give a great impetus to the mining industry. The Allied Gold Mines, which is conducting an extensive diamond-drilling campaign, has cut what is believed to be a continuation of the Miller Independence vein and also a parallel vein of considerable width stated to carry good ore. The Peerless is sinking a shaft to the 200-ft. level. At the Campbell-Duncan claim rich ore has been encountered in a test-pit.

GOUDREAU.—The Consolidated Mining & Smelting Co. has purchased six claims of the Webb-McCarthy-Miller gold properties, near Goudreau, for $400,000. One of the conditions of the purchase is that the company shall erect a reduction works on the property.

MEXICO

CONSTRUCTION OF CYANIDE PLANT TO BE RESUMED. CANANEA INCREASING OPERATIONS.

CHIHUAHUA.—Construction of the 600-ton cyanide plant by the American Smelting & Refining Co., at Minas Nuevas, in the Parral district, has been resumed. The work is being done under the direction of Bernard MacDonald, who has a force of Mexicans in his employ. The building of the plant was started early this year, but shipment of machinery was interrupted about four months ago by a raid made by a force of revolutionists under Villa, who tore up a long stretch of track on the Parral branch of the railroad. The destroyed portion of the line has just been repaired and traffic resumed. It is stated that the recent defeat of Villa's forces in Durango may lead to the early reopening of the smelter of the American Smelting & Refining Co. at Asarco, in that State.

SONORA.—Information has been also received here that the Cananea Consolidated Copper Co. will be operating its mines and smelter at Cananea to full capacity by the end of this month. The working force was recently increased by taking on one thousand additional men. This company has suffered many interruptions during the last several years as a result of revolutionary operations. It is stated that all departments of the smelter have been overhauled and are now in prime condition for a heavy and continuous run.

Yaqui Indian bands operating to the south of Moctezuma make for uneasiness among the mining men of that district, particularly in view of the recent looting of properties. Lately, scouting parties of rancher volunteers have gone out of Moctezuma to ascertain whether or not the Indians have returned to their hill haunts or still are looting ranches. All the small villages and ranches have been deserted and not a few of the mines, the people gathering in Moctezuma and Cumpas. The Government has taken no steps toward running down the Indians. The Progresso Mining Co., whose property is situated about 10 miles north of Batuc, has started to work on a wagon road to Tepache. This road, running from Moctezuma to Suaqui, was built before the revolution but lately has fallen into such disrepair that Andrew Macfarlane, manager of the property, has had considerable difficulty in getting in a plant of machinery for development operations. The Progresso has large bodies of milling ore as well as stringers of high-grade rock. A road recently built to Hermosillo had to be abandoned by the company owing to Yaqui depredations. The road now being repaired will serve a number of mining properties in the vicinity of Suaqui, Batuc, San Pedro, Tepupa, Sahuaripa, Bacanora, and Mina Mexico.

H. J. Wendler, manager for the Buena Vista Mining Co. in the Moctezuma district, has returned from Los Angeles. Work on the company's mill, in charge of James Lord, was completed about September 1. It has been planned to sink a shaft to develop water for operation of the concentrator, but heavy rains have delayed the start on this work. A large tonnage of concentrating ore is assured and plans now are being formulated for the construction of a reverberatory matting furnace. It is probable that a cupelling furnace also will be built so that silver bullion may be taken out at the property. This will obviate shipment of concentrate and will make a big saving in freight, treatment, and other expenses. The Mina Blanca, owned by Manuel Vasquez of Nacozari, has been leased by F. Murrietta, who is working it. A large tonnage of 100-oz. silver ore has been shipped from the old dumps and the upper workings. As soon as the rainy season has ended, Mr. Murrietta plans to unwater the mine and take out higher-grade ore said to have been found in the lower levels. There also are large bodies of low-grade silver on the lower levels, which, under the prevailing market, can be shipped at a profit.

ARIZONA

Nogales.—The Bachman-Merrit company will build a mill to treat its vanadinite ores at its Tres de Mayo mine, 12 miles east of Nogales.

Prescott.—The Tuscumbia has been taken under bond by Richard Kingdon of Jerome.——The Emporia has been acquired by J. Gardner Scott of Hollywood.——The Zero has been taken over by Eli Perkins and associates of Prescott under the new name of the N. C. 4 Mining Co, and a crew of men is at work cleaning out.——The Mark Twain, under bond to J. F. Healy, is working several men.——The Monte Cristo is being operated by W. L. Worthington, from Nacozari, and J. Hubbell, of San Francisco, opening up a new vein 8 ft. wide of good silver-gold ore.——The Hidden Treasure adjoining is being operated by Bennett, of Prescott. The Midnight Test is operating 6 Nissen stamps under the management of Francis Clark.——There is little activity in Copper Basin, but the Zonia to the south is under bond to J. F. Healy, who is working several lessees. ——The Silver King was recently bonded to people from Jerome.

In the Hillside country, the King continues to ship zinc ore, but has been hampered by the excessive rains.——It is reported that the Bagdad Copper Co. will resume operations in Copper Creek about October 1. Mr. Guysendorfer was a recent visitor to the property.

Tucson.—The Paymaster Silver-Lead Co., owner of the Paymaster mine, situated 24 miles south of Tucson, in the Olive camp, is planning to build a mill. Charles Blenman, of Tucson, is president and W. F. Hagan treasurer and manager.

CALIFORNIA

Alleghany.—The mill at the Morning Glory is being enlarged, and mine developments increased. It is stated that ore assaying $20 to $50 has been encountered and that the property is in excellent condition. A. A. Codd, Reno, Nevada, is manager.

Dedrick.—Work with a small crew has been resumed on the Globe quartz mine following an idleness of many months. Driving from the lower tunnel is proceeding to open promising ground. M. Elliott is manager and A. B. Cousin, foreman.

Graniteville.—Work has been resumed at the Spotswood gravel property with two shifts employed. The tunnel is undergoing repairs and re-timbering preliminary to being extended to reach the channel.

Moores Flat.—A 6-ft. vein of high-grade gold ore has been opened in the Crackerjack by Buck brothers. The vein was tapped in a raise from the main tunnel and shows visible gold in profusion. All the ore is said to be of good milling grade, with veinlets running high in gold. Nevada City is the nearest supply point.

Redding.—The Reid mine in Old Diggings is shipping from 150 to 200 tons of ore per day to the Mammoth Copper Co. at Kennett. Fifty thousand tons of gold ore from the Reid is piled up in the smelter yards.——Diamond-drills have been set at work prospecting the copper claims of W. H. McEwen and I. O. Jillson on Oak Run, 16 miles east of Redding. This is a camp that has lain dormant for years. ——The Atascadero Copper Co., which runs the Greenhorn copper mine near Tower House, is contemplating erecting reduction works soon. Experiments are being carried on in Oakland to determine the best method of treating the ore. A decision will be reached in about thirty days. In the meantime the company will keep on with development. Albert Hanford, of Redding, is superintendent.

MICHIGAN

The production of ingot copper from the mines of the Michigan district for the month of August was 13,302,886 lb., a decided increase over the output for July but only 70% of normal production. The outstanding features of the August showing were the increase in the production of the Calumet & Hecla of nearly a million pounds, the decided increase in the Ahmeek and Osceola mines, the exceptionally high-grade yield shown in the Champion mine of the Copper Range, as well as the increase in copper total. La Salle drops out entirely and Superior's output is practically nothing. Winona entered the list of producers for August, but had not operated long enough to get any mineral to the smelter.

The following statement gives the approximate copper produced at all the mines in the Michigan copper district. In some of the mines the figures are official smelter and mine records; in others they are estimates, but the approximations are conservative in each instance.

	Ore	Lb. per ton		— Refined —	
	tonnage	Aug.	July	Aug.	July
Ahmeek	55,890	22.2	20.8	1,245,300	958,500
Allouez	13,600	18	14.5	245,800	150,100
Baltic	20,000	34	35	680,000	654,500
Calumet & Hecla	165,472	25	22.4	4,136,818	3,292,821
Centennial	5,075	13.9	15	70,500	76,002
Champion	45,000	40	35	1,800,000	1,330,000
Isle Royale	58,865	18	18	1,059,583	935,150
Mass Con.	7,143	14	14	100,000	92,321
Michigan	5,000	32.2	..	161,254	184,175
Mohawk	43,157	21.36	23.4	922,209	1,012,575
Osceola Con.	56,700	14.4	13	817,600	651,000
Quincy	90,000	18	18	1,620,000	1,500,000
Superior	650	17	20	11,000	35,025
Victoria	10,000	12.5	16.5	130,000	108,900
Wolverine	27,493	14.65	13.8	402,822	331,736

IDAHO

Coeur d'Alene.—The orebody at the Idaho Carbonate Hill Con. M. Co.'s property is reported to have widened to five feet.—Work has been resumed at the Chicago-Boston property of eight claims at Lake gulch on the south side of the Coeur d'Alene river near Wallace.——Copper King continues in ore, and a sample across 2½ ft. of the vein is reported to carry 6.9% lead, 10.5% zinc, and 3 oz. of silver. ——The St. Lawrence property on the Montana side of the Coeur d'Alene divide contemplates a 2000-ft. tunnel at a cost of $35,000. No further ore shipments are contemplated for a year.

Northern Idaho.—The Armstead Mines, operating at Talache, Idaho, on Pend Oreille lake, has decided to engage

in development for another year before beginning the construction of a concentrating mill. In the development of this property the management has so far driven a large tunnel to the 4000-ft. point, together with a raise and several cross-cuts, and has driven on the No. 3 and 2 tunnel levels. ——The shoot struck recently on the 500-ft. level of the Richmond mine at Adair has been followed by a drift for more than 100 ft. The shoot is two to five feet wide and contains copper sulphides of shipping and milling grades. A streak of peacock ore six inches wide was disclosed by recent driving.

UTAH

Tintic.—Ore shipments from Tintic for the week ending September 19 were considerably increased, the total being 133 carloads, compared with 117 carloads the week before. Water troubles, which seriously interfered with the output a week ago, have been satisfactorily adjusted, thus accounting for the improvement noted. The shippers follow:

Chief Consolidated	35
Iron Blossom	20
Dragon Consolidated	15
Tintic Standard	12
Mammoth	7
Eagle & Blue Bell	7
Colorado Consolidated	6
Empire Mines	6
Centennial Eureka	5
Gemini	5
Swansea Consolidated	4
Grand Central	4
Ridge & Valley	4
Alaska Lease	1
Victor Consolidated	1
Total	133

Park City.—For the week ended September 19, Park City mines shipped a total of 3,951,730 lb. of ore, or 1976 tons, compared with 2070 tons a week ago. Of this amount Ontario shipped 710 tons, while Silver King Con. is credited with 110 tons. Shipments in pounds follow:

	Pounds
Ontario Silver	1,421,200
Judge M. & S.	1,096,420
Silver King Coalition	1,000,680
Daly West	213,430
Silver King Con.	220,000
Total	8,951,730

BRITISH COLUMBIA

On account of the high wages already paid at Hedley, and the demand for still higher wages, and on account of the continued high cost of the supplies, I. L. Merrill, president, and G. P. Jones, superintendent, have recommended to the board of directors that the mill should be closed this fall and that the development work at the mine should be continued, using the surplus on hand for this development work, instead of for the payment of dividends. Their recommendation has been approved by the board of directors.

Nelson.—Travel by trains and boats into the Slocan mining district, usually heavy at this period of the year, is the greatest in its history. Trains and boats are crowded. The increased travel is brought about by a resumption in some of the mines and by an increased activity in mining operations generally, it is said.

KOREA

Unsan.—The clean-up for August was $62,500. Taracol was shut-down for 17 days because of scarcity of water, but is now in full operation again.

PERSONAL

Note The Editor invites members of the profession to send particulars of their work and appointments The information is interesting to our readers.

W. W. Mein is in San Francisco.

W. M. Brewer has returned to Vancouver.

George W. Goodchild is here from London.

J. N. D. Gray has returned from Scotland to Los Angeles.

T. A. Rickard has returned from the Coeur d'Alene, Idaho.

Gilmour E. Brown has gone to Balloch, Dumbartonshire, Scotland.

Preston Locke has been at Stewart in the interest of the A. S. & R. Co.

G. L. Sheldon of Denver was in Chaffee county, Colorado, in early September.

H. C. Colburn has returned to San Francisco from a business trip to Colorado.

Sergio Bagnara passed through San Francisco last week on his way to New York.

W. W. Wishon, of Searchlight, Nevada, is in the Caribou district, British Columbia.

I. F. Aguilar Revoredo has opened an office as consulting mining engineer at Casillo 176, Oruro, Bolivia.

J. J. O'Neill, who has been making geological examinations in the Stewart district, has returned to Ottawa.

Alpheus F. Williams, general manager for the DeBeers Consolidated Mines in South Africa, is in San Francisco.

Carl Tombo, of Philadelphia, and **Burr Evans,** of Placerville, were examining mines in El Dorado county this month

W. S. McCann, who has been making geological examinations in the Lilloet district, passed through Victoria on his way to Ottawa.

Herbert H. Roe, after a short visit to London and France, sailed from Liverpool on the 'Celtic' for New York, on his way to California.

C. M. Eye, formerly superintendent for the Benguet Consolidated Mining Co. of Benguet, P. I., and now States representative for that company, is at the Hotel Stewart, San Francisco.

Obituary

H. A. J. Wilkens, of Wilkens & Devereux, New York, died on September 13 in Colorado.

Henry B. Underhill, Jr., who died on September 14, was first employed by Thomas H. Selby (at one time Mayor of San Francisco) in 1866. The original firm, the San Francisco Assaying & Refining Company, was bought out by Kellogg, Hewston & Co., representing Thomas H. Selby, and the Selby Smelting Co. was formed from that concern. Mr. Underhill became the assistant secretary of the Selby Smelting & Lead Co. Later he became secretary, and remained in that position until 1906. Upon the resignation of Mr. Ralston, Mr. Underhill was made president of the company, and held that office until 1918, when the Selby Smelting & Lead Co. was dissolved as a corporation. The works still continued to be known as the Selby Smelting Works, operated by the American Smelters Securities Co. Mr. Underhill's work was not technical during these years in the company He was in the financial end, for many years selling silver Handling the silver question was his special forte. Mr Underhill was associated with the business for a period of 52 years until the dissolution of the corporation, within a year and a half of his death. He remained president until the end. He was always recognized as a very courteous and kindly gentleman, and will be deeply mourned by his many friends.

THE METAL MARKET

METAL PRICES

San Francisco, September

Aluminum dust, cents per pound	60
Antimony, cents per pound	9.50
Copper, electrolytic, cents per pound	23.00
Lead, pig, cents per pound	6.50—7.50
Platinum, pure, per ounce	$71.70
Platinum, 10% iridium, per ounce	$110
Quicksilver, per flask of 75 lb	$105
Spelter, cents per pound	9.00
Zinc dust, cents per pound	11.00—13.50

EASTERN METAL MARKET

(By wire from New York)

Sept. 24—Copper is dull and easy. Lead is easy. Zinc is weak.

SILVER

Below are given official or ticker quotations in cents per ounce of silver 999 fine. From April 23, 1918, the United States government paid $1 per ounce for all silver purchased by it, fixing a maximum of $1.01½ on August 15, 1918, and will continue to pay $1 until the quantity specified under the Act is purchased, probably extending over several years. On May 5, 1919, all restrictions on the metal were removed, resulting in fluctuations. During the restricted period, the British government fixed the maximum price five times, the last being on March 7, 1919, on account of the low rate of sterling exchange, but removed all restrictions on May 10. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the normal rate of exchange.

Date	New York cents	London pence	Average week ending	Cents	Pence
Sept. 17	113.50	61.75	Aug. 12	110.58	58.02
18	113.50	61.75	" 19	112.68	59.14
19	113.87	62.00	" 26	112.00	60.66
20	114.75	62.00	Sept. 2	111.45	58.93
21 Sunday			" 9	111.99	60.96
22	114.50	62.12	" 16	112.77	61.14
23	114.50	62.62	" 23	111.10	62.04

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	75.14	88.72	101.12	July	78.92	99.62	106.36
Feb.	77.54	85.79	101.12	Aug.	85.10	100.31	111.35
Mch.	74.13	88.11	101.12	Sept.	100.73	101.12	...
Apr.	72.51	95.35	101.12	Oct.	87.38	101.12	...
May	74.61	99.50	107.23	Nov.	85.97	101.12	
June	76.44	99.50	110.50	Dec.	85.97	101.12	...

COPPER

Prices of electrolytic in New York, in cents per pound

Date		Average week ending	
Sept. 17	22.25	Aug. 12	22.20
" 18	22.25	" 19	22.33
" 19	22.25	" 26	22.83
" 20	22.12	Sept. 2	22.55
" 21 Sunday		" 9	22.37
" 22	22.00	" 16	22.29
" 23	21.75	" 23	22.10

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	29.53	23.50	20.43	July	29.67	26.00	20.82
Feb.	34.57	23.50	17.34	Aug.	27.42	26.00	22.51
Mch.	36.00	23.50	15.05	Sept.	25.11	26.00	...
Apr.	33.10	23.50	15.23	Oct.	23.50	26.00	...
May	31.69	23.50	15.91	Nov.	23.50	26.00	...
June	32.57	23.50	17.53	Dec.	23.50	26.00	...

LEAD

Lead is quoted in cents per pound, New York delivery.

Date		Average week ending	
Sept. 17	6.25	Aug. 12	5.64
" 18	6.20	" 19	5.68
" 19	6.20	" 26	5.88
" 20	6.20	Sept. 2	5.90
" 21 Sunday		" 9	5.83
" 22	6.20	" 16	5.97
" 23	6.20	" 23	6.20

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	7.64	6.85	5.60	July	10.93	8.03	5.53
Feb.	9.10	7.07	5.13	Aug.	10.75	8.05	5.78
Mch.	10.07	7.26	5.24	Sept.	9.07	8.05	
Apr.	9.38	6.99	5.05	Oct.	6.97	8.05	
May	10.29	6.88	5.04	Nov.	6.38	8.05	
June	11.74	7.59	5.32	Dec.	6.49	6.90	

TIN

Prices in New York, in cents per pound.

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	44.10	85.13	71.50	July	62.60	93.00	70.11
Feb.	51.17	85.00	70.13	Aug.	62.53	91.33	67.5
Mch.	54.27	85.00	70.50	Sept.	61.51	80.40	
Apr.	55.63	88.53	72.50	Oct.	67.34	78.87	
May	63.21	100.01	70.75	Nov.	74.18	73.07	
June	61.93	91.00	71.83	Dec.	85.00	71.52	

ZINC

Zinc is quoted is spelter, standard Western brands, New York delivery, in cents per pound.

Date		Average week ending	
Sept. 17	7.55	Aug. 12	7.65
" 18	7.50	" 19	7.80
" 19	7.50	" 26	8.00
" 20	7.50	Sept. 2	7.89
" 21 Sunday		" 9	7.76
" 22	7.50	" 16	7.65
" 23	7.45	" 23	7.50

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	9.75	7.78	7.44	July	8.98	8.72	7.78
Feb.	10.45	7.97	6.71	Aug.	8.58	8.78	7.81
Mch.	10.78	7.67	6.53	Sept.	8.33	9.58	
Apr.	10.20	7.04	6.49	Oct.	8.32	9.11	
May	9.41	7.92	6.43	Nov.	7.76	8.75	
June	9.63	7.92	6.91	Dec.	7.84	8.49	

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. Prices, in dollars per flask of 75 pounds:

Date		Date	
Aug. 26	100.00	Sept. 10	103.00
Sept. 2	95.00	" 16	105.00
		" 23	105.00

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	81.00	128.06	103.75	July	102.00	120.00	100.00
Feb.	126.25	118.00	90.00	Aug.	115.00	120.00	103.00
Mch.	113.75	112.00	72.80	Sept.	112.00	120.00	..
Apr.	114.50	115.00	73.12	Oct.	102.00	120.00	..
May	104.00	110.00	84.80	Nov.	102.50	120.00	.
June	85.50	112.00	94.40	Dec.	117.42	115.00	....

FOREIGN EXCHANGE

Foreign exchange made substantial gains this week, both sterling and the Continental rates showing improvement. However, this does not necessarily mean that a definite turning point has been reached. The franc will hardly recover much until prospects become definite of a large credit to France. That country is reported as inquiring as to feasibility of a $300 000 000 loan here and, while deferring the issue as far as possible, can hardly wait beyond the year end for aid if no general scheme is meanwhile evolved. The latest entry in the wholesale procession of European applicants is Esthonia. On this hemisphere a South American republic, presumably Chile, is said to have practically closed for a $40 000 000 loan. Peru also is needy. Sterling continues to gain strength gradually, thanks to improved prospects of relief under the Edge bill as a general factor, and more particularly on purchases against Transvaal gold bound here.

The Edge bill, the joint work of Senator Edge and Governor Harding of the Federal Reserve Board, providing for a federal charter for international banking and financing corporations as the best means of rectifying the now much disturbed foreign-exchange situation, has passed from the Senate to the House committee on banking and currency. Corporations can be organized immediately after passage of the Edge bill to assist our allies, and need not await signing of the peace treaty, but it is impossible to say whether many banks will avail themselves of the privilege at once. Although they feel the necessity of assisting our allies by extending credits they consider this a national matter in which the Government should participate by lending more than moral support.

On a basis of 5% of capital and surplus of national banks, approximately $400 000 000 is theoretically available for investing in the stock of these corporations. This sum could be somewhat increased by investments of private bankers and others, but would be inadequate to meet the present situation, it is thought.

Senator Edge has given the following description of benefits to be derived from his export finance bill: "It means acceptance of the principle that the national banking system should be expanded to recognize the necessity for cooperating in export financing. This measure will be a complement of the Webb-Pomerene law; just as the Webb law permits commercial combinations for export business, so does this permit export financial combinations. Such financial corporations, it is true, may now be organized under State statutes, but under Federal incorporation and under supervision of the Federal Reserve Board they unquestionably will be doubly safeguarded and their debentures be far more attractive to investors. Finally, as Governor Harding of the Federal Reserve Board has well said, 'wild-catting will be precluded.'

"Although reasonable and adequate Federal supervision is provided, however, it may be stated that there is neither Federal participation nor underwriting nor guarantee.

"Beyond the direct benefit to America, the bill means much indirectly. It will stimulate our already shrinking exports by opening foreign markets, and the opening of these channels to all parts of the world means continued operation of all our industries, with consequent employment of labor at adequate wages. It means cargoes for our American merchant marine, now well over 1000 ships. It means normal and healthy readjustment of foreign exchange, and it means the preclusion of foreign embargoes or other discrimination against American goods. Finally, it means the rehabilitation of Europe, so that at a time it may repay its tremendous debt to the United States."

Quotations on September 23 are as follows:

Sterling:	Cable	4.18
	Demand	4.17
Francs:	Cable	8.55
	Demand	8.57
Lire:	Demand	9.27
Marks		3.00

Eastern Metal Market

New York, September 17.

All the markets are quiet. A possible steel strike and the unsettled condition in foreign exchange is checking progress.

Demand for copper continues light and is being satisfied by metal from second hands.

The tin market continues dull; spot tin, however, is scarce and firm.

Prices of lead have been advanced but trading is not heavy.

Buying of zinc is insignificant and confined to immediate needs. Prices have again declined.

Antimony is lower.

IRON AND STEEL

The net result of the persistent and disturbing agitation for a steel strike has been that little buying has appeared. Although it is probable that conservative leaders in the labor world will prevail and that there will not be a general strike of iron and steel workers, the threatened suspension of operations still causes apprehension. Pig-iron demand is not active and there are reports of weakness in basic and other steel-making irons. Awards of structural steel continue promising, a total of 27,500 tons being involved in large projects.

COPPER

The metal available from dealers and second hands continues to regulate the market. Considerable surprise has been the rule recently over the amount of copper thus offered. One explanation of this, and an interesting one, is that the Japanese have been offering considerable copper in this market. It is estimated that Japanese interests bought at least 15,000 to 20,000 tons in the days of heavy buying some weeks ago. This fact was called attention to in these letters. It seems now that there has been a change of conditions in the Japanese market for which this metal was originally purchased for consumption, in fact, more or less of a collapse there, and that this has caused the sales of some of the copper here. It is calculated that about 2000 to 3000 tons of this has been sold here recently. From outside sources electrolytic copper is available for early delivery anywhere from 22.12½ to 22.75c., New York, with Lake copper about ¼c. above those levels. Large producers of electrolytic continue to quote in most cases 23.50c., New York, for early delivery and 24c. for October and last quarter, though it is stated that one or two have sold at ¼c. under these levels. Demand in general is light.

TIN

The steel situation as to a possible strike continues the dominant factor. It is holding all buyers in check, there being no reason to buy if there is a strike as it is figured that prices of tin will fall. It is the opinion of one important broker that there is more reason for an advance than a decline in tin. The unprecedented situation in foreign exchange rates has also a retarding effect. If these two serious problems are adjusted satisfactorily it is believed that the tendency of the price of tin will be distinctly upward. The week as a whole has been a slow one in trading. Although there are heavy quantities of tin afloat, 6965 tons to date, most of this has been sold for consumption with the result that spot tin is scarce and firm. Spot Straits tin, New York, is quoted at 56.50c., New York, Lamb & Flagg, 99%, 55.25c., New York, and American electrolytic, 55.75c., New York. Arrivals of tin so far this month have been 1575 tons, of which 450 tons came through Pacific ports. Future shipment prices yesterday were: Straits for September-October shipment from the East, 54c; Straits for September shipment from England, 54.50c.; Lamb & Flagg for early October shipment, 54c. The London market is higher with Straits quoted yesterday at £288 per ton.

LEAD

The market is stronger and higher. On Monday the American Smelting & Refining Co. advanced its quotation from 6c. to 6.25c., New York, and the outside market followed suit. The St. Louis price is 6c. It is not believed that these levels can be shaded, not yet at least, in the outside market. The advance by the leading interest came as something of a surprise. To those well posted, however, it was not unexpected. It is claimed that production is light and stocks less than estimated by many and that a pinch in the market, particularly in the East, is probable this winter at the latest.

ZINC

There is no improvement in the market. The uncertainty of labor conditions in the steel market and the unprecedented exchange rate values are both holding this market, as well as others, back. Prices have continued to melt in the past week until yesterday prime Western for early delivery was obtainable at 7.15 to 7.20c., St. Louis, or 7.50 to 7.55c., New York, which we quote as the market. Prices for last quarter are indefinite without buyers or sellers being interested in view of the uncertainty of the future. Some producers are understood to be finding it to their advantage to buy zinc instead of producing it at present costs of labor and ores.

ANTIMONY

The strength of the silver market is stated to be the only factor that is keeping this metal from selling lower. Wholesale lots for early delivery are obtainable at 8.50c., New York, duty paid, with jobbing lots at 8.75 to 9c., New York.

ALUMINUM

No alteration in conditions or prices, which continue at 32 to 33c., New York, for wholesale lots for early delivery of No. 1 virgin metal, 98 to 99% pure.

ORES

Tungsten: The tariff question is still holding up the market. Very little business has been done and the market is disorganized. Opinions as to the duty question are at variance and there is not unanimity among those interested. A committee has been appointed to watch developments and determine what steps are necessary to protect the trade, according to a well known broker. The last quotations were nominal at $7.25 to $7.50 for Chinese ore, $12 for Bolivian, and $15 for Western scheelite.

Molybdenum: The market is quiet with quotations nominal at 70 to 75c. per lb. of MoS_2 in regular concentrates.

Manganese: The uncertainty as to the future of the ferro-manganese market has checked what little business was possible. Brazilian and Indian ores have been offered at 55 to 60c. per unit, seaboard.

Manganese-Iron Alloys: Demand for ferro-manganese is confined to carload and lots up to 300 tons for early delivery. The British producers are no longer attempting to 'dump' their product in American markets at $95, seaboard, but are quoting $105, seaboard, against the American price of $110, delivered. Both are about equivalent. Spiegeleisen is very quiet at $35, furnace.

ON another page we publish a description of the new Elmore process, which is designed to separate and extract lead and zinc from their ores and concentrates. The inventor is Mr. Francis E. Elmore, of oil-flotation fame. It will be noted that the company owning the patent is a strong one financially. We look forward to a successful demonstration of the process in this country.

CAR shortage for railroads, despite much unfavorable comment, is less serious than in recent years prior to the War, according to Mr. Walker D. Hines. He adds that the construction of 100,000 freight-cars ordered by the Railroad Administration is being hastened, and that every effort is being put forth to improve the service. We greet these announcements with the hope that triumphs over experience.

EVERY good citizen will regret the illness of the President and wish him a speedy recovery. Nervous dyspepsia is no joke, as most hard workers in office and library are only too well aware. The President's transcontinental tour of speech-making and public receptions must have involved a tremendous strain, mental and physical, one reacting on the other. His health today is precious to the country; we hope he may regain it speedily, so as to complete the serious business on hand.

JOHN C. GREENWAY is being mentioned in the Arizona press as a likely candidate for the United States Senate. We hope that the idea will be translated into action, for it goes without saying that he would make a good representative in the upper house of the Congress. Our readers are aware of his splendid record in two wars and of his successful administration of large mining enterprises, in the course of which he showed the highest qualities of a man and a citizen. The Senate would undergo a process of secondary enrichment if a few men of his type were added to its membership; just now it looks as if descending solutions had impoverished the outcrop.

ANOTHER institute has changed its name, by adding a reference to metallurgy. The Australasian Institute is now "of Mining and Metallurgy", following the example set by the similar American and Canadian organizations. There is much of "the everlasting monkey in man," as Marion Crawford said long ago. We deplore these changes in titles because 'mining' included geology, ore-dressing, and metallurgy, together with the other arts and sciences applied to the winning of metals from their ores; hence the specific inclusion of the metallurgist only serves by implication to exclude the geologist, chemist, and other necessary technicians among those engaged in the industry of mining.

IT was announced at Paris that on September 25 the Supreme Council of the Peace Conference approved the report of the commission on Spitzbergen granting to Norway the political suzerainty over that group of islands in the Arctic sea. Spitzbergen, as our readers are aware, has been a *terra nullius*, or no man's land. Its anomalous status has checked industrial development, although an American coal enterprise was established there before the War under the leadership of Mr. John M. Longyear of Lansing, Michigan, and under the resident management of Mr. Scott Turner, now at Toronto. Just before the War the governments of Norway, England, Russia, and Germany had agreed to a conference for the purpose of arranging a joint control of the islands, but the outbreak of hostilities shattered the scheme. Disputes arising under the common law were tried at Tromsö, the nearest port, in Norway. The Norwegians are the logical caretakers of Spitzbergen, and we are glad therefore that the nations of the League have given her the political control.

TULE CANYON, Nevada, which extends south from Mount Magruder toward Death Valley, has lately become the scene of renewed activity in placer mining. This deposit of gold-bearing gravel is a valley some 12 miles long, and has long engaged the attention of capitalists interested in alluvial mining. Many examinations have been made with the idea of washing the gravel on a large scale, but each time the gold tenor, when calculated for the area required for extensive operations, has been considered too low to justify the necessary expenditure. More recently two organizations, the Tule Canyon Placer Association and the Goldfield-Tule Canyon Placer Mining Company, have started drift-mining in search of high-grade pockets that are known to exist. The gravel above bedrock is saturated with water, so that all that is necessary to obtain an abundance for washing is to sink a shaft thirty or forty feet deep through the gravel and erect a pump. It is quite possible that an erratic deposit too low-grade to warrant exploitation on a large scale may pay handsome profits to smaller organizations, with low overhead expenses, that are content to explore

for the high-grade pockets and work them in a small way; yet in these days of prohibitive costs, when established gold mines are struggling for their existence, it requires no small courage to start new work in a field that has been abandoned for years.

EMIGRATION is being much discussed, often with dire forebodings of the effect of a million or so foreigners returning to their own countries and taking with them four or five billion dollars in savings. All the money, of course, would be spent in their native lands; and the withdrawal of so many men from the ranks of labor would make a difficult situation still more difficult. Now comes the U. S. Commissioner of Immigration, Mr. A. Caminetti, deploring the "hysteria that exists in relation to emigration." He states that only 102,513 foreigners have left the United States since the signing of the Armistice, and a total of only 123,522 during the year ending June 30, 1919. In the five years ending June 30, the total was 618,225, as compared with 1,172,679 immigrant arrivals for the same period. This, of course, was during the War, when many foreigners did not return to their native countries through fear of being forced into military service. It seems likely that emigration will increase over the figures we have quoted, but apparently much of the fear of serious consequences is hardly warranted.

IT is announced that Mr. Edwin F. Gay, dean of the graduate College of Business at Harvard, has been appointed chief editor of the New York 'Evening Post', a great newspaper in the days when it was edited by such men as Lawrence Godkin, William Bryant, and John Bigelow, and even in later days, until Mr. Oswald Villard so tarnished its reputation as to cause the recent change of ownership. This appointment is interesting to us in California because Dean Gay had been mentioned as a possible successor to Mr. Benjamin Ide Wheeler in the presidency of the State university. His remarkable record during the War, as organizer of a series of bureaus of statistical information for the Shipping Board, the War Trade Board, and the Board of War Industries, had marked him as a man of extraordinary executive ability, so that before he left Washington he was asked by the President to organize a new bureau of all governmental activities. He is an expert in economic, international, and political matters. We wish him every success in his new field of work. After all, the editorship of a newspaper is a position of greater influence than the presidency of a university. As editor of the 'Evening Post', Mr. Gay will not only instruct the minds and sway the opinions of thousands, but he will influence the relatively few whose influence counts in his community. We would have liked to see such a man at the head of one of our San Franciscan papers rather than president of the University of California. Our universities are doing good work; our newspapers are beneath contempt. Whoever may be selected as the new president of the State university, even if he be on a parity with Dr. R. L. Wilbur of Stanford University, he cannot undo the evil done daily by an ignorant and meretricious press—two in the morning and two in the evening. We ought to have men of wide learning and high character, such as are selected to be presidents of universities, as editors of our newspapers, because the newspaper is no less a means of education, and it operates for a longer period. The best of the youth of California, for instance, goes to Berkeley and Palo Alto for three or four years and during that brief period comes under the influence of the presidents of the two universities; but for twenty minutes or more every morning and every evening, and longer every Sunday, they have to sit mentally next to Mike de Young, Fremont Older, and William Randolph Worst. The influence of a high-minded College president is felt during an impressionable period, it is true, but that influence becomes less and less as the number of students runs into thousands; what good influence he exerts, largely through his faculty, is soon swamped by the iterative mental smudge left by a cheap and nasty newspaper. The community or State that spends millions annually on its University and allows its press to be controlled by accidental persons of no character is making a huge mistake. We hope the regents will elect a good president for the University, but we wish almost against hope that some man of equal moral worth could be placed at the head of at least one of our newspapers in San Francisco.

The Steel Strike

The strike of the steel-workers, which was started on September 22 to the accompaniment of riot and bloodshed, is running its course. It is a portentous event because it is the culmination of labor truculence, stimulated by a long series of successful strikes and encouraged by the timidity of the Administration at Washington. Like the big strike now paralyzing British commerce, this attempt of the workers in one of our basic industries is likely to develop into a contest, not with a group of manufacturers, but with the Government itself, for the Congress has taken cognizance of it and intends to inquire into the causes of it, a procedure that may compel the President himself to interfere. In the end the influence of public opinion will make itself felt unmistakably, and perhaps it is as well therefore that the strike should not have ended abruptly, because a sudden ending would have prevented the exposure of the factors that brought it about. The workers, through their leaders, complain that they cannot maintain a decent American standard of living. To this statement the Steel Corporation replies with the following average earnings for an eight-hour day: heaters, $21.12; roughers, $11.92; catchers, $11.92; steel-pourers, $12.84; vessel-men, $14.65; engineers and manipulators, $12.03. The average earnings of men employed on a twelve-hour shift are as follows: blooming-mill heaters, $17.92; skelp-mill heaters, $18.18; skelp-mill rollers, $21.73; lap-welders, $16.08; blowers, $13.76; bottom-makers, $12.91; regulators, $13.52. These are skilled workmen. Semi-skilled labor is paid $4.44 to $8.26 per shift, usually of eight hours, and the majority earn over $6 per day. Common labor

receives 45 to 50 cents per hour, or $125 to $140 per month, on the basis of an eight hour day the maximum pay for skilled labor therefore is $21.73, whereas the minimum for common labor is $3.50. Another published statement gives the pay of the skilled employees as from $7 to $80 per day, and that of the unskilled as from $3.50 to $6. These figures do not justify the strike. If the commonest, most ignorant, alien laborer can earn four or five dollars per day, he is not warranted, under Irish-American leadership, in upsetting the whole country by means of a strike. A few days ago Mr. Hoover, referring to the building of his house at Palo Alto, said: "I have noted that the skilled laborer on this job is receiving $8 to $9 per day. As trustee of this university [Stanford] I note also that some 150 instructors and assistant-professors receive from $3 to $6 per day, and that they have families to support." One would suppose, from the wild talk of the leaders of the labor-unions, that they were the only people that are suffering from the high cost of living, whereas the fact is that common labor has had its demands adjusted more to its benefit than any other class of workers. As for skilled labor, in the mills, dockyards, and foundries, it has held this country by the throat during the War and has profited enormously during the five years that proved so calamitous to the rest of the world. But this strike is not one for higher wages only; it is a fight for the 'closed shop', that is, the recognition of the union and the compelling of every worker to join that union, so that the leaders of it may represent all the men in their collective bargaining with the corporation. For ourselves, we look forward to the day when every worker will join the union to which he naturally belongs, so that collective bargaining will be conducted on a truly representative basis, and, what is more important, the good citizens among the workmen will be in the union and assert themselves in it, to the discomfiture of the professional agitator. As it is now, the conservative and peace-loving workman keeps out of the union, leaving it in the hands of a minority of hot-heads; if a strike supervenes, he goes elsewhere, again leaving the control of affairs to the radical minority. The corporations are fully organized, and the workers should be likewise organized, not for purpose of battle but for the adjustment of their relations on a fair basis. The principle of refusing to permit combinations in restraint of trade should serve as an embargo on the combination of unions outside any one State. The so-called nation-wide strike is a colossal conspiracy against the nation, and it should not be tolerated. It is to be noted that this strike, affecting a vital national interest, was precipitated by a small group that was restive under the sagacious leadership of Mr. Samuel Gompers. The chairman of the strikers' committee is John Fitzpatrick, who, in his evidence before a committee of the Senate, asserted that the working conditions in the steel industry were "intolerable". Pinned down under cross-examination, he admitted that he had never worked in the steel-mills, had never been inside them, and was ignorant of the process of steel-making, and so had formed his impressions of working conditions altogether from hearsay. He said that the skilled workers obtained "a mere pittance for the work they do" and asserted that "the industry pays less than paupers get." He himself was receiving $75 per week as an organizer, or about as much as a first-class professor in a university. The investigation by the Congress is a good thing; it will elicit the information that the public needs in order to arrive at the merits of the quarrel. It should be noted that when Mr. Gompers was called before the Senate committee he testified that the strike had been started against his advice, which was to delay it, in accord with President Wilson's request, until after the Labor Conference on October 6. He acknowledged that the strikers were mostly aliens. "It has been said," he testified, "that most of the men taking part in this strike are of foreign birth and not naturalized citizens. That may be, and no doubt is, true. The largest proportion of steel corporation employees are of foreign birth, but these men were brought here by the companies." The last statement is fully warranted; the big corporations did combine with the steamship companies in swamping the truly American element in our population with a horde of inferior stocks, and it is, in a measure, a logical result that an unruly Irish-American should now lead these gangs of Finns, Slovenes, and Austrians in revolt against them. However, the quarrel does not concern these aliens and the steel-making corporations only; it concerns the public, it concerns the people as a whole. The manufacturers and the unions seem to overlook this fact, but before their quarrel is settled they will find that they have a reckoning to make with the nation. These fights between factions have been too frequent of late; the public is weary of them, and will shortly be irritated into calling for Government intervention. Meanwhile it is highly desirable that the causes of the strike be investigated impartially and that the public be given the information needed for a correct opinion. To us at this time it appears that the strike savors of industrial sabotage on the part of an unruly group of aliens, who talk of "the American standard of living" while they are engaged in making life in America difficult for the American people.

Herbert Hoover

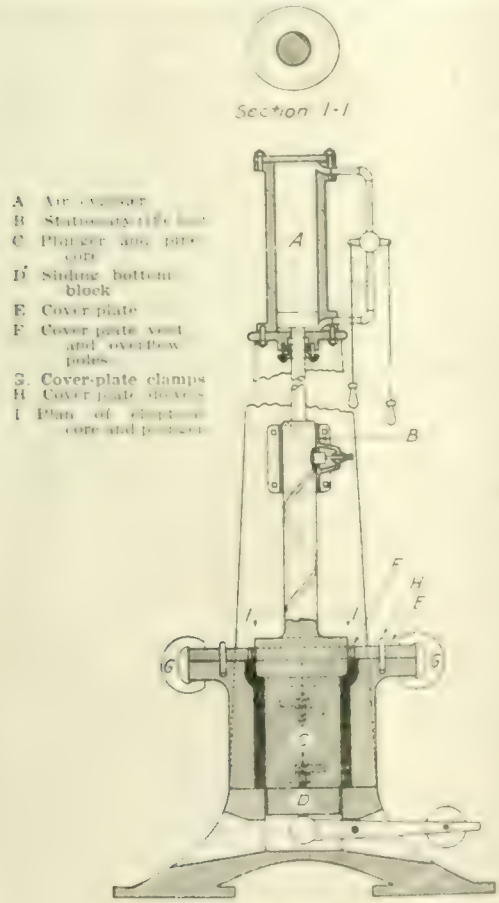
On another page we give the full text of the speech delivered by Mr. Hoover at the recent dinner organized, in behalf of the engineering profession, by the American Institute of Mining and Metallurgical Engineers. The dinner was given at the Waldorf-Astoria hotel in New York on September 16; it celebrated Mr. Hoover's return home on the conclusion of his work in Europe; it was intended as a tribute of respect and admiration for the manner and success with which that humanitarian service had been performed; but it was more than that, it testified to the pride of the engineering profession of America in a fellow-craftsman who had proved himself a great leader of men during the anxious years when civilization seemed tottering to its downfall. The occasion was marked by an extraordinary assembling of the

members of his own profession and of his other friends. Twelve hundred or more went through the form of dining in order to take part in the celebration. It was not only a personal triumph for Mr. Hoover, it was the triumph of the American mining engineer. Other members of our profession have won international fame, some of them by *spectacular* tactics and others more worthily. He was not the first to be consulted by the kings and emperors of the old world, but those who preceded him were retained to advise upon the exploration of imperial estates or the exploitation of mineral deposits in colonial regions, whereas this Californian mining engineer was called upon to advise cabinets and governments in matters far more vital to human welfare: to prevent the starvation of whole populations and to save entire nations from the economic chaos of misgovernment. Our readers know the story. In 1914, when the Germans began to over-run western Europe, Mr. Hoover was honorably prominent as a mining engineer and financier in London. The opening days of the War were marked by a rush of Americans from the belligerent countries and the gathering of panic-stricken refugees in London itself. This exodus from Europe involved much distress and confusion. Mr. Hoover stepped forward promptly and aided the representatives of the United States by organizing a committee for assisting the refugees, with a success to which thousands of his fellow-countrymen are eager to testify. Soon afterward the plight of Belgium made an appeal alike to his human sympathy and to his executive ability; he organized the Commission for Relief in Belgium, taking with him in this work several of those who had helped him in steering and expediting the stream of American travelers and fugitives. What he did for Belgium is written large across the page of history. Next, as soon as his own country entered the War, he undertook the task of directing the distribution of foodstuffs in the United States; he was appointed Food Administrator and organized a bureau that not only proved of immense value to the national cause but won the cordial support of the American people, without distinction of class. As soon as the Armistice was signed he was asked by the President to serve as director-general of the Allied Relief Commission in Europe. Last February the Congress appropriated a hundred million dollars for this new benefaction; altogether he has had the spending of 800 million dollars and the responsibility of directing the economic salvation of two continents. Initiative and resourcefulness are not uncommon, it may be, but the combination of such qualities with a statesmanlike mind is rare indeed. The speech with which he answered the enthusiastic proposal of the toast in his honor—a toast proposed under the sobering limitations of a beverage compounded of ginger-ale, lemon, and ice-water, but stimulated by the intoxicating eloquence of an exuberant chairman—exhibits the insight of a student of history, the sagacity of a social philosopher, and the mature wisdom of a man who has surveyed mankind from China to Peru. Only 45 years old, he reveals a statesmanship that is rare at any age. He sees through the futile schemes of the half-educated proletariat of Europe and exposes the pitiful vagaries of the anti-social mobs that have stood astride the wreck of civilization; he brings us back to first principles and demonstrates the fact that human happiness is dependent first upon productivity and then upon a fair division of the products of honest industry; for our benefit he analyzes the economic break-down in Europe, not to make us contemptuous of men and women in distress but to make us wary of following the shallow philosophies and rash experiments of those who have been crazed by the revolutions that have followed upon the heels of unsuccessful war. To the American people he brings a message couched in no uncertain tone, and he delivers it with all the authority of a prestige won by successful foresight and tremendous achievement. We have departed from the ideas of the old world and we have been spared from sharing its agony; it is for us to be humbly thankful for our good fortune and to be honestly purposeful in our effort to preserve our social ideals, not in selfish aloofness, but with a humane sympathy for those less fortunate than ourselves and a keen desire to help them in their trouble, as Mr. Hoover has done. Shall we flatter ourselves by regarding him as an exponent of the American spirit? He has set a standard of world service that not only we as individuals but the United States as a nation should be proud to accept as its own. He has directed the production and controlled the distribution of the resources of nature for the benefit of mankind at a time when mankind most needed such organization and leadership, as was suggested by Mr. W. L. Saunders, who presided at the dinner. Mr. Saunders quoted the definition inscribed on the wall of the library in the United Engineering Societies building in New York: "Engineering, the art of organizing and directing men, and controlling the forces and materials of nature for the benefit of the human race." This paraphrases the older definition to be found in the charter of the oldest engineering society, the Institution of Civil Engineers, in England: "The art of directing the great sources of power in Nature for the use and convenience of Man." In Mr. Hoover the initiative and resourcefulness that belong to a pioneer people were brought to the point of major effectiveness, as also by the American soldier in the closing days of the War, but in him they represented the combination of an unusual inheritance and a special training, from his Quaker forefathers in Indiana and from his university in California, supplemented by world-wide travel and by an experience of which it may be said that it broadened his sympathies for other peoples while deepening his love for his own country, its spirit, its ideals. In these days when the engineering profession is awakening to the responsibilities of citizenship and becoming articulate in its demand to serve the State, it is more than fortunate that an engineer and his engineer assistants should have demonstrated their fitness for the biggest work that our industrial civilization can require in times of crisis. Mr. Hoover has given the world a true conception of the function of the engineer, he has directed the resources of Nature to the welfare of man; in him the dream of engineering has come true on a heroic scale.

Utilizing Furnace Slag

The Editor:

Sir—Why is not slag made into useful products by compressing it in suitable forms and molds while in a liquid state in the way that glass is so perfectly molded? Smelting companies buy from distant points clay products such as building brick, hollow tiles, sewer and drain



UTILIZING FURNACE SLAG

pipe, etc., and also use lumber and concrete for purposes that could be better served by slag products made on the spot if there were some satisfactory method of molding shapes from their own slag. With this thought in mind, I am suggesting in my sketch a scheme for making sewer pipe, which is a somewhat difficult shape to make and burn even with good clay. If sewer pipe can be made in the way I describe, brick, hollow-tile, and simple shapes like launder-liners of dense structure and true to form could be still more easily made.

Before starting operation the mold is heated by placing a red-hot iron billet in it. When this is removed a proper size ladle of slag is dipped from the well on the side of the furnace, or from the slag stream if the furnace has a continuous flow. The slag is poured quickly into the hinged mold *C*. Instantly the plunger is brought down into and through the mold. This plunger forms a core for the inside of the pipe and at the same time forces the liquid slag outward and upward against the inside of the mold, the pressure forcing the entrained air and surplus slag out through the vent-holes in the top cover-plate *E*. The plunger or core is not round but elliptical, and descends and rises with a twisting motion caused by the rifled nut *B* on the plunger-rod. The plunger is allowed to rest at the bottom of its stroke until the slag is partly set but still plastic. Before the slag has become entirely hard the plunger or core is raised out of the mold by the air-piston with the same twisting motion with which it entered. Consequently, as the plunger is elliptical the plastic slag forming the walls and bell of the pipe is further compressed and the inside of the pipe enlarged to the diameter of the long axis of the ellipse. The newly made slag-pipe is allowed to cool somewhat in the mold. The top cover-plate *E* is then removed, the divided mold unlatched, and the half swung back on its hinges and the slag-pipe taken out. The mold is closed and latched again, the top cover-plate replaced and clamped down, and it is ready for another pour, as the mold is still hot from the previous cast. The toughness of the slag-pipe would depend upon the composition of the slag and the care taken in gradually cooling or annealing the pipe after it is made. But it would surely be more dense and durable than the ordinary vitrified or partly vitrified clay pipe of commerce and also much cheaper to make.

This scheme may seem at first a radical departure that is uncertain of success, but really it is only applying to slag the method commonly used in the glass factories for molding articles of glass by compressing them while in a molten state. The glass people can now make in this manner big pieces of intricate shape and design, but it was necessary for someone to experiment before they reached their present perfection. Similarly slag products will not be perfectly made until someone tries the scheme properly.

W. M. BAKER

McGill, Nevada, September 10.

The Crowe Process

The Editor:

Sir—Mr. E. M. Hamilton, in his contribution to 'Discussion' in your issue of September 6, misses entirely the consideration of the patentability of the Crowe process and apparatus, which I denied in my letter. An essen-

trial requirement of the U. S. Patent Office before the granting of a patent for a process or for an apparatus, is that the alleged invention be novel, that is, new. Let us see whether there is anything new in the combinations of the elementary parts which constitute the three claims which I put forward in my letter as sample ones of the thirty-one of the patent.

Claim 4 reads: "The process of precipitating material from its solution which consists in subjecting the solution to a vacuum and precipitating the material from the solution." This claim, if it could be sustained as novel, would be the strongest of the thirty-one. But in each of the four anticipations which I cited in my letter there was material in solution, the solution was submitted to a vacuum, and the material was then precipitated. If claim 4 has any legal control in the art involved, no one, without the consent of the owner of the Crowe patent, can now use the apparatus and process described in the anticipations cited by me and described by Lamp in 1907; by Tweedy and Beals in 1910; by Chase in 1911; and by Carpenter in 1915. The corollary of this is that a claim for an older combination of elementary parts has no patent, or patentable, value.

Claim 14 reads: "In an apparatus for precipitating material from its solution, a closed chamber receiving the solution, and means for creating a vacuum in said chamber to remove from the solution gases which interfere with precipitation." This claim is for the apparatus, and claim 4 is for the process. Each of the four anticipations that I cited contains the combination of elementary parts of claim 14, namely: The apparatus, the closed chamber, and the means for creating the vacuum for removing the gases.

Claim 29 reads: "The process of precipitating valuable metal from metal bearing cyanide solutions, which consists in removing from the solution gases which interfere with the precipitation and subsequently precipitating the valuable metal therefrom by flowing the solution in contact with a metal capable of precipitating the valuable metal from the solution." Each of the four anticipations includes descriptions of how the valuable metals were brought into solution, the gases removed, and how they were precipitated by flowing the solution in contact with zinc; precisely as this claim No. 29 recites.

Such patent claims are worthless, and the remaining 28 are equally so.

Mr. Hamilton, referring to my contentions, has mixed his postulates. He uses as headings (1) anticipated, and (2) consciously anticipated. Then he discusses under (1) anything and many things other than the anticipations I cited in my letter; and then under (2) assumes that I failed to show that the anticipations were due to conscious efforts to benefit the solutions by deaeration. I did not hold that there was any conscious effort in that direction. As to patentability, either conscious or unconscious intentions or efforts have no bearing.

Liquids submitted to a vacuum part with their occluded gases, and assume inherent or innate qualities. In that way they acquire the quality which is claimed as newly applied under the Crowe so-called invention. There is nothing to show in the patent that that quality is the invention of Crowe. A quality is not patentable. A new method of conferring a quality on a material is patentable. And so is an original apparatus for the method. But in the case of the patent under consideration neither quality, method, nor apparatus was new in 1916.

I will not encumber the record with criticism of Mr. Hamilton's immaterial statements. Mr. Hamilton misses the statement made on page 35 of the Julian and Smart book, which is as follows: "A cyanide solution of 0.2% is then passed through the ore and the loss noted." There we have a cyanide solution passed through the ore into a Wolff bottle, used as a vacuum-chamber, from which entrained or occluded air is withdrawn by a well-known exhausting apparatus, thus preparing the solution for subsequent treatment. This, the last stage in metallurgical practice, is precipitation of its metal content.

I will correct one of Mr. Hamilton's statements by quoting from Mr. Crowe's paper: "When the vacuum was suddenly applied a cloud composed of thousands of small air-bubbles rose out of the solution . . . also proving that the relief of atmospheric pressure on the solution permitted the dissolved air to escape."* This has been long known in physics. The solution was quiescent in an acid bottle, and the top surface only was submitted to the vacuum. Also: "A vacuum system was applied to pregnant solution in November 1917, but no definite results can be given at this time beyond stating that precipitation is uniformly lower than before adoption."† This was in the Barnes-King mill, at Marysville, Montana.

Spraying a liquid in order to expose a greater surface to the action of a vacuum was practised in the arts years before this alleged invention.

All my statements and criticisms are intended to be in the interest, or for the benefit, of the mining and metallurgical engineers and operators.

N. S. KEITH.

Philadelphia, September 11.

LABOR CONDITIONS in Alaska continue unsettled, although there have been and are no indications of trouble of any kind. Laboring men assert that the wages offered by the mining and public works industries are not such as justify them in laying off their coats and going to work, with the result that coats are being worn by a considerable number of the working class. The fact remains, however, that there is plenty of work at which men can make from $3.50 to $5 per day and board.

THE ALASKA AERIAL CO. was recently incorporated in Seattle for $500,000, for the purpose of building five DeHaviland biplanes, three of them large and to cost $50,000 each, to be operated as passenger and freight carriers between Valdez, Fairbanks, Nome, and Arctic points in Siberia. Machine shops for the upkeep and maintenance of the biplanes will be constructed and operated at Valdez.

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*Bull. A. I. M. E., August 1918, page 1279.

†Loc. cit., page 1290.

Herbert Hoover on Conditions in Europe

Text of His Address at the Dinner Given in His Honor by the American Institute of Mining and Metallurgical Engineers

I have been asked to speak to you on some of the impressions that I have gained during my service in Europe since the Armistice. Two convictions are dominant in my mind. The first comes from contact with the stupendous social ferment and revolution in which Europe is attempting to find solution for all its social ills by practical experiments in Socialism. My conviction is that this whole philosophy is bankrupting itself from a startling quarter in the extraordinary lowering of productivity of industrial commodities to a point that, until the recent realization of this bankruptcy, was below the necessity for continued existence of their millions of people.

My second conviction is older but has been greatly hardened, and that is a greater appreciation of the enormous distance that we of America have grown away from Europe in the century and a half of our national existence, in our outlook on life, our relations toward our neighbors, and our social and political ideals. The supreme importance of this Americanism neither permits us to allow the use of this community for experiment in social diseases, nor does it permit us to abandon the moral leadership we have undertaken for restoring order in the world.

During the last ten months I and my colleagues have occupied a unique position in intimate witness of the social currents that have surged backward and forward across Europe.

The enemy collapsed not only from military and naval defeat but from total economic exhaustion. In this race to economic chaos the European Allies were not far behind. By this exhaustion, the whole of Europe stood facing a famine the like of which has not been seen since the Thirty Years war, when a third of the population died of starvation. In the midst of all this was the struggle of a score of new democracies to establish themselves, with friction along every frontier, and, with the destruction of governmental institutions, without financial resources to buy supplies, with the miseries of their people offering fertile soil for every economic patent medicine and for all the forces of disorder, Bolshevism, and anarchy, and, overhanging all, there could be no hope of restoring normal economic life until the completion of peace. In all this situation, with its desperation, greed, century-old animosities, its idealistic and proper aspirations, there was only one hope. That hope, expressed by every city and state, was that the American people, being the one disinterested and uncrippled economic and political force still existing in the world, should again intervene. It was in response to this call that the President, comprehending the real heart of the American people, intervened in Europe a second time and took those steps which resulted in a practical economic organization of Europe, pending the consummation of peace and the arrival of the forthcoming harvest.

This second intervention was not a relief problem in the ordinary acceptance. It was not a problem alone of finding foodstuffs for starving populations of the ravaged regions. It was the problem of finding a large margin of foodstuffs and other supplies for the whole of Europe—allies, liberated peoples, neutrals, and enemies; and in a mass of at least 200 millions of these people formerly under enemy domination it was a problem of finding absolute economic rehabilitation. Further than this, it was a problem of warding off Bolshevism on one side and reaction on the other, in order that the new-born democracies could have an opportunity for growth.

Its practical consummation was a problem of the organization of the economic strength of the United States and its co-ordination with the remaining economic strength of Europe, and, in large areas, the imposition of absolute dictatorship over economic forces. Thus, the shipping of the world required sufficient co-ordination to transport 30 million tons of supplies from all quarters of the globe to Europe. It required the provision of credits to those countries whose total exhaustion abolished all hope of normal payment. It required the insistence upon payment from those who had gold or commodities. It required sufficient co-ordination of purchase in this vast quantity of supplies that the markets of the world should be affected in the least possible degree. With the dissolution of the organization of the old channels of communication, river craft and railway rolling-stock were hoarded by each State; telegraph and postal communications were broken down; every frontier was the scene of more or less military friction, until at one moment there were 25 little wars in progress. Many of these new governments were without experience or even without the existence of departments for the conduct of either the transportation or distribution of supplies.

Thus, it was necessary to secure the creation within their governments of actual departments, to furnish them advisors, to take over the actual operation of thousands of miles of disintegrated railway systems, to open rivers and canals for traffic, to stimulate the production of coal and other primary commodities, to control their distribution through large areas, to find a basis for exchange of surplus commodities from one State to another, to exercise the strongest political pressure to obtain the disgorgement of surpluses into areas of famine, to resort to barter

on a national scale where currencies had broken down, to stimulate peoples discouraged and disheartened to efforts in their own salvation, and finally, but not least, to intervene a charitable hand in the saving of their children and the stamping out of contagious diseases, and through all of this economic disorganization to inspire the maintenance of order on one hand and the defeat of reaction on the other. Beyond this again, the necessity of constant friendly intervention in frontier quarrels to prevent the starting of more wars.

These things have not been solved by the service or direction of any one man. They have been accomplished through co-ordination of the men of good will in twenty governments of Europe and throughout by creation of a thread of American personnel, directed from a single centre. On our side it has required the co-operation of Congress, the Grain Corporation, the Treasury, the Shipping Board, the Army, and the Navy. A thousand Americans were sent into these communities with but little authority beyond their own assurance and the confidence on all sides that they were disinterested, that their only desire was to solve a great and human emergency for no political and no commercial advantage. It was our desire to do this from the background, without ostentation, to act at all times through established institutions, to build up their strength for the time they must rely upon their own resources. I cannot pay enough tribute to all these thousand Americans, many of them engineers, men taken from the common life of the United States, thrust into the face of staggering political and economic problems, the solution of which must affect the well-being not of hundreds but of millions. The proof of their performance lies in the fact that Europe has come through the most terrible period of its history with no loss of life from economic causes, with a stronger democracy and a glow in its heart for the United States.

This service of American people has been accomplished at no mean national sacrifice. From the Armistice to this year's harvest there has been furnished over two and a quarter billion dollars' worth of supplies, the majority of which has been given freely upon the undertaking of the assisted governments of re-payment at some future date. There has been no demand of special security; no political or economic privileges have been sought. It may be years before we receive any return from these loans, but if that period should never come the American people, by this second intervention in Europe, have saved civilization, and have done so with no thought of the burden or cost to themselves. These matters have been brought to a successful close with the arrival of the harvest and the prospect of peace. What the future has a right to demand from us in further economic support is not yet clear, but it is at least certain that if the world cannot quickly secure the settlement of peace and safeguards for the future through the League, the whole of our two great interventions in Europe will have gone for nothing, and the menace of reaction will again return against us upon the wings of chaos.

As the executive head of this Allied effort in economic control I have thus had an intimate contact with the common people and their officials. I have witnessed their improving physical condition, the constant change of currents of social, political, and economic forces, their revolutions, and I have had to deal intimately with the results of all these phenomena. During this period since the Armistice, we have witnessed social and political revolution among one-third of the civilized world, and we see the remainder in great social tribulation. No contemporary can properly judge or balance the relative volume of great currents of social agitation. They are matters of mind and not of matter. Yet practical statesmanship requires that within our abilities a constant accounting should be taken of the tangible results of these forces abroad, if the development of our liberal institutions and the progress of orderly government is to be maintained and revolution avoided.

This cataclysm of social change in Europe is the result of the long cumulation of social as well as political wrongs; it is no sudden afterthought of war. These forces were projected into actual realization by the collapse of the War, the breakdown in the political institutions that had preceded it, and the misery that has flowed from it. Our soil is not so fertile as that of Europe to many of these growths, because we have a larger social conscience. We have not the vivid class and economic distinctions of Europe, nor have we the depth of misery out of which these matters can crystallize. Nevertheless, in these days of intimate communication, social forces are rapid in their penetration and social diseases are quick in universal infection.

The general revolution of Europe of the last century, starting with the French revolution, profoundly changed the whole social order of the world, and, while in that revolution the spiritual impulse was the demand for political liberty, there was also a great economic impulse. That economic impulse was primarily the division of the land, and one of the fruits of that revolution was the better distribution of wealth among the agricultural population. Since that time an enormous expansion of mechanical industrialism has been superimposed upon all agricultural States, with a large increase in urban populations. The economic impulse of the revolution today is the demand for a better division of the wealth from this industrialism, and this time the agitation arises mainly from the urban populations.

These vast masses of humanity in Europe have long been groping for the method of nearer equality of opportunity and better distribution of the results of industrial production. These gropings and these attempts have in recent years been dominated by Marxian Socialism, developed in different degrees of intensity. Broadly, these revolutions have taken two forms: the Bolshevik form, through which there has been over-night 'communization' of all property, and second, the milder form of legislative nationalization of industry. I believe we are now in position to take some stock of and to form some judgment as to the adequacy of these solutions for what I believe every liberal-minded man believes is a necessity—the better division of industrial production.

We require only a superficial survey to see that the out-

standing and startling economic phenomenon of Europe today is its demoralized industrial production. Of the 450 million people in Europe, a rough estimate would indicate that they are at least 100 million greater than could be supported on the basis of production, which has never before reached so low an ebb. Prior to the War, this population managed to produce from year to year but a trifling margin of commodities over the necessary consumption and to exchange for supplies from abroad. It is true that in pre-war times Europe managed to maintain armies and navies, together with a numerically small class of non-producers, and to gain slowly in physical improvements and investments abroad, but these luxuries and accumulations were only at the cost of a dangerously low standard of living to a very large number. The productivity of Europe in pre-war times had behind it the intensive stimulus of a high state of economic discipline; the density of population at all times responded closely to the resulting volume of production. During the War, the intensive organization of economy and consumption, the patriotic stimulus to greater exertion, and the addition of women to productive labor, partially balanced the diversion of man-power to war and munitions. Both the pre-war and the war impulses have now been lost and the productivity of Europe has steadily decreased since the Armistice.

It is true that some of this diminution in production has been contributed to by the other factors, but in the larger degree the cause of this steady decrease of productivity, with its shortage of necessary supplies and its rising cost of living, must be sought in the social ferment, with its continuous imposition of Socialist ideas. In this ferment the advocates of Socialism or Communism have claimed to alone speak for the downtrodden, to alone bespeak human sympathy, to alone present remedies, and to be the single voice of Liberalism.

We may examine these phenomena a little more closely. In Russia we have a great country in which the population, with the exception of a small minority, were comparatively well fed, warmly clothed, and warmly housed. They were subject to the worst of political tyranny, were deliberately steeped in ignorance and superstition, yet their productivity was sufficient to enable them to provide these primary comforts and to export more foodstuffs than the United States. Socialism was brought in over-night at the hands of a small minority of intellectual dilettanti and criminals, and this tyrrany of minority, more terrible even than the old, has now had nearly two years in which to effect the conversion of the wicked competitive system into the Elysium of Communism. Today two-thirds of the railways and three-fourths of the rolling-stock that they control are out of operation. The whole population is without any normal comforts of life and is plunged into the most grievous famine of centuries. Its people are dying at the rate of hundreds of thousands monthly from starvation and disease. Its capital city has diminished in population from nearly 2,000,000 to less than 600,000. Prices have risen to fantastic levels. The streets of every city and village have run with the blood of executions, nor have these executions been confined to the so-called middle and upper classes, for lately the opposition of the workmen and farmers to this regime has brought them also to the firing squad in appalling numbers.

If we examine the recent proclamations of this group of mixed idealists and murderers, we find a radical change in their economic and social ideas. They have abandoned the socialization of the land, for they find the farmer will not produce for payment in high-flown and altruistic phrases. They have re-established a differential wage and in an attempt to stimulate exertion and ambition of skilled labor. They have established a State Savings Bank, in order to stimulate production through making provision for family and old age. They are offering fabulous salaries for men capable of directing the large agencies of production. In fact, while in the midst of flowery verbal endeavor to maintain that they are still Socialists, they are endeavoring to restore individual ownership of property and of the results of labor. The very high-priest of Socialism is today vainly endeavoring to save his people from their total destruction by summoning back the forces of production. The apologists of this debacle are telling us that it is due to the Allied blockade, and to various other oppositions, but any one with a rudimentary knowledge of Russia knows that they did have within their borders ample supplies of food, coal, oil, wool, flax, cotton, and metals, and the factories with which to work them in abundance, and that their sole deficiency is human effort.

We could take another example of Bolshevism in the efforts of Bela Kun and his colleagues in Budapest. The distinction between this situation and Russia is that they were dealing with a population of much higher intelligence, of much higher average education, and it required but three months for the working people of Budapest to realize the fearful abyss into which they had been plunged. It was solely due to the efforts of the trade-unions in Budapest that the Bolshevists were thrown out of Hungary.

These are the extreme points where Socialism has had its opportunity for immediate and wholesale application, according to all of the precepts of its advocates. Elsewhere in Europe Socialism has proceeded through established institutions and we may shortly examine the results here also.

During the War large measures were taken on both sides of the front to secure the mobilization of production and distribution to its maximum use in the struggle. There was effective socialization of vast sections of industry. These measures are being continued and extended today in many places by governments anxious to maintain the stability of institutions even at the sacrifice of economic safety, but under the threat of minorities of revolutionary action. Yet here again the same prime weakness has proved itself. The only partial success of these measures in war was due to the great patriotic impulse of war. Those who conducted these large operations were men whose initiative and capacity had been

selected by the competitive system. These war impulses have been lost, and these organizations with constantly decreasing efficiency even in war now face disaster from further reduced productivity. All these decreases have immediate results in a rising cost of living or the necessity of governments to subsidize commodities—such as bread. There is no better example of this than the coal industry of Europe, and even omitting Russia, this production has fallen from a rate of 600 million tons per annum at the Armistice to a rate of 450 million tons recently. The coal industry is in modern life the very life-blood of the State, and it has proved itself the most susceptible among all the industries to these influences, and its production today is at such an ebb as to jeopardize the entire social fabric. I am convinced that the greatest proportion of European leaders of Socialism today to some extent realize this bankruptcy and are today endeavoring to cover a retreat with loud complaints as to the failure from other causes. Nevertheless, the realization itself is a great step and is bringing the turn of the tide and through it Europe is on the road to economic recovery—if she gets peace.

The whole of these various sorts of Socialism is based on one primary conception, and that is that the productivity of the human being can be maintained under the impulse of altruism and that the selection of the particular human for his most productive performance can be made by some superimposed bureaucracy. Their weakness is the disregard of the normal day-to-day primary impulse of the human animal, that is, self-interest for himself or for his family and home, with a certain addition of altruism varying with his racial instinct and his degree of intelligence. They fail to take into account, also, that there is but one sufficiently selective agent for human abilities in that infinite specialization of mind and body necessary to maintain the output of the intricate machinery of production, and that is the primary school of competition.

My emphatic conclusion is, therefore, that Socialism as a philosophy of possible human application is bankrupt.

Although Socialism has now proved itself with rivers of blood and suffering to be an economic and spiritual fallacy and to have wrecked itself on the rock of production, I believe it was necessary for the world to have had this demonstration. Great theoretic and emotional ideas have arisen before in the world's history and have, in their bankruptcy, deluged the world with fearful loss of human life. A purely philosophical view might be that these experiences are necessary to humanity, groping for something better. It is not necessary, however, that we of the United States, now that we have witnessed these results, should plunge our own population into these miseries and make a laboratory for experiment in foreign social diseases.

Bankruptcy of the Socialist idea, however, does not relieve us from the necessity of finding a solution to the economic question which underlies all this discontent. That economic question is the future division of the products of industry and the steady development of higher productivity. This bankruptcy of the Socialist idea should, if reaction is to be prevented, return the guardianship of this problem from the radical world to the liberal world of moderate men, working upon the safe foundations of experience.

The paramount business of every American today is this business of finding a solution to these issues, but this solution must be found by Americans, in a practical American way, based upon American ideas, on American philosophy of life. A definite American substitute is needed for these disintegrating theories of Europe. It must be founded on our national instincts and upon the normal development of our national institutions. It must be founded too upon the fundamental fact that every section of this nation, the farmer, the industrial worker, the professional man, the employer, are all absolutely interdependent upon each other in this task of maximum production and the better distribution of its results. It must be founded upon the maximum exertion of every individual within his physical ability and upon the reduction of waste both nationally and individually. We can well see a vivid confirmation in Europe of the fundamental economic principle that the standard of living and the cost of living is the direct quotient of the amount of commodities produced; that we must secure a maximum production of the industrial machine if we wish to keep our population alive or if we wish to see an increase in the standard of living of our people. From this only can arise the very foundations of the higher activities of life. The application of this proposition must, however, stand several tests. A maximum production can only be obtained under conditions that protect and stimulate the physical and intellectual well-being of the producer. We shall never remedy justifiable discontent until we eradicate the misery which the ruthlessness of individualism has imposed upon a minority.

If I were thinking aloud I would say at once that this maximum production cannot be obtained without giving a voice in the administration of production to all sections of the community concerned in the specific problem; that it cannot be obtained by the domination of any one element. I would say that the human race had increased its standards of productivity and therefore of living through the growth of extraordinarily intricate organization of production and distribution based upon stimulation of the individual by the reward it offers. I would also say that it cannot be obtained from the destruction or sudden disturbance of this delicate and intricate organization of production and distribution or extravagance in its products. I would say the road lies along the better division of the more exorbitant profits that arise from these processes and that have accumulated from them. By better division of profits, I do not refer particularly to profit-sharing schemes, but to the broad issue of the whole social product. Some are comparatively overpaid and many are comparatively underpaid for the service they render to the community. Our organization in many aspects is not all that we could desire, but it is the

best we have been able to evolve over thousands of years, and the destruction of these processes or of the organization which conducts them, has been demonstrated to be the sure road to destitution and fearful loss of life.

It is not that we, today, have suddenly awakened to this necessity for better distribution of profits. The social conscience of this country has been manifesting itself continuously concerning this matter for years. We have in the United States today a better division of wealth and a greater equality of opportunity than any other nation in the world, and we have thus a better foundation upon which to build. We have reason for discontent in the fact that our industrial development has outrun our social progress; and we have reason to hasten those measure that lead to larger justice in the distribution of these profits and larger representation of all elements of the community in the control of these agencies, to further strengthen our measures for the restraint of economic domination by the few and for the liquidation into the hands of the many of the larger industrial accumulations in the hands of the few that our rapid development has made possible.

Again I wish to repeat, the observation of these forces in Europe has reinforced my Americanism during these last ten months of intimate contact with them; it has revealed to me the distance of our departure from the political, social, and economic ideals of Europe. There has grown in this United States a higher sense of justice, of neighborly service, of self-sacrifice, and above all a willingness to abide by the will of the majority in every section of this community. This Americanism is the guarantee of the ability of our people to solve this most momentous internal problem confronting our generation. But these very ideals, this very sense of justice and service for our own people give us still further opportunities. Our sister civilization in Europe is today recovering from a great illness. The many new democracies that we have inspired are striving for our ideals. We alone have the economic and moral reserve with which to carry our neighbor back to strength. To do this is also true Americanism.

Wallace Thompson, formerly American vice-consul at Monterrey, Mexico, says American investments in Mexico had grown to value of $2,000,000,000 when Diaz fell in 1911. Physical damage to American property is estimated at $80,000,000. Damage claims totaling $500,000,000 have been filed with the American State Department, including claims for losses in profits during the period of revolutions. Of $300,000,000 invested in Mexican oilfields, $200,000,000 is American. Actual physical losses of American oil companies are placed at $5,000,000. This does not include failures of most of 300 American companies that have put money into Mexican oil, nor does it take into consideration potential losses if Carranza enforces his "nationalization" plan. The Carranza tax system now in force is said to cost the oil companies $1,000,000 monthly. American investment in Mexican mining is placed at $200,000,000 with physical losses of $15,000,000. The greatest damage to mining properties was indirect, resulting from abandonment during periods of fighting. National Railways of Mexico, worth $250,000,000 as physical plant alone when taken over by the Carranza government in 1914, has been all but destroyed.

Mining in Washington in 1919

The metal output of the mines of Washington during the first half of 1919 was seriously curtailed by the drop in the prices of metals which followed the signing of the Armistice, according to C. N. Gerry, of the U. S. Geological Survey. Production, however, will probably increase as conditions adjust themselves to normal times. The metal output in 1918 was valued at $1,467,421, a decrease from $2,289,285 in 1917. The present rate of shipments indicates that there will be decided decreases in the output of gold, silver, and lead in 1919. The ore output in 1918 was 138,911 tons, part of which was milling ore. Chewelah district, in Stevens county, produced 3517 tons of concentrate and 1442 tons of crude shipping ore, and the Republic district produced 42,213 tons of shipping ore. The monthly shipments of copper ore and concentrate from Chewelah district were not greatly changed in 1919, but the shipments from Republic were curtailed to less than 2000 tons per month in the early part of the year. The shipments of copper ore from Index, in Snohomish county, were maintained, but those from Okanogan county decreased decidedly. The metal output in 1918 was $304,658 in gold, 310,093 oz. of silver, 1,922,406 lb. of copper, 5,271,815 lb. of lead, and a few pounds of zinc. No shipments of zinc ore were made from either Northport or Metaline Falls in the early part of 1919.

The conditions and prospects in the smelting industry were by no means encouraging. The Northport Smelting & Refining Co. closed its lead plant on February 25, and the Tacoma smelter was said to be running only one out of three copper furnaces. As the smelter at Trail, B. C., refused custom ore from Washington, the Electric Point mine was forced to ship to Midvale, Utah. In March operations were suspended at this mine, which is the source of most of Washington's lead output. A new flotation plant was constructed at the Loon Lake mine, in Stevens county, a drossing plant was added to the equipment at Northport, and ore of good grade was opened at depth in the United Copper mine at Chewelah.

Considerable attention is now being drawn to the Valdez district, Alaska, on account of a platinum discovery eight miles from the town. The ground also contains another mineral which is believed to be tungsten. Many claims have recently been located. The ground is admirably situated for hydraulicking, and there is water in abundance. The Tsadell district, also near the Valdez, is now being extensively prospected and many rich ore samples are being brought in.

The Power-Plant, Machine-Shop, and Foundry of the Utah Copper Company

By FRANK G. JANNEY

Power is being furnished to the Utah Copper Co.'s plants at Garfield by the Utah Power & Light Co. and is delivered from their terminal station, about five miles west of Salt Lake City, over two steel-tower transmission lines at 42,000 volts, three-phase, sixty-cycle, to the Utah Copper company's central station at Magna. These lines are connected into the station through 70,000-volt oil-circuit breakers to a ring bus in the station; each line is protected with reverse-energy relays, which, in the event of trouble on either of the lines, automatically disconnects it from the system, thus avoiding an interruption to the plants.

The ring bus, which is composed of 1-in. copper tubing, is so arranged that any part of the equipment can be cut out for inspection or repairs, through sectionalizing switches, without affecting service. Distribution is made from this station to the various sub-stations at the Magna and Arthur mills. Power is delivered to each sub-station with two circuits of three wires each of 250,000 C. M. stranded conductors at a potential of 42,000 volts; both circuits are supported on steel towers with suspension insulators, each circuit is controlled with overload relays, and is of ample capacity to furnish all power required at point of delivery.

At the sub-station the circuits are controlled by 44,000-volt oil circuit-breakers from which power is delivered to a vertical bus, supported with suspension insulators, through disconnecting switches and an automatic 44,000-volt circuit-breaker, to the transformers, through which the pressure is reduced to 460 volts. The installation at the Arthur sub-station consists of three banks of transformers, having a normal capacity of 21,500 kva. supplying current to 1283 motors, ranging in size from ¼ to 300 hp. at 440 volts. An extra transformer is provided and arranged with primary and secondary switches so that it may be put in service to relieve a defective transformer without causing an interruption of service.

The secondary distribution circuit to the motors is of three-conductor varnished cambric insulated cables with a double-braid weather-proof covering, tested for a working voltage of 1000 volts. Each secondary circuit is protected with an automatic oil-switch, through inverse time-limit overload-relays. Motors are protected with overload-relay and low-voltage release, by which in event of an interruption of power-service, all motors are automatically disconnected from their supply-circuit.

A complete signal system of colored lights is maintained between the sub-station and all parts of the mill, enabling the operators to control the power-supply at all points, and thus avoid any unnecessary high-peak demand. This signal system is also used for reaching any of the foremen or heads of departments that may be needed. A telephone system is also maintained with instruments placed in all offices and convenient places in the plant, thus enabling the superintendent and others in charge to be in close touch with operations in the various departments. The efficacy of the telephone and signal system is best demonstrated during an interruption of power service. When all the machinery is at rest the time required to get it moving and operating rarely requires more than 12 or 15 minutes.

Foundry. In 1910 this was in a small, poorly lighted and ventilated building 61 by 62 ft. Outgrowing this small building, a new shop was completed in the early part of 1911, the building being 80 by 120 ft. Remodeling and additions to the mills and the building of the Bingham & Garfield railroad increased the work to such an extent that the foundry was lengthened 75 ft. in 1912, 30 ft. in 1915, and 90 ft. in 1917. Today the main building of the foundry covers a space of 80 by 315 feet.

After allowing for chipping-room, core-room, and cupola-space, the molding-floors have an approximate area of 16,000 sq. ft. The foundry equipment is modern in every respect, making work-conditions ideal. In the core-room are modern oil-fired furnaces. The crane equipment includes two 15-ton traveling cranes in the central bay and one 3-ton electric traveling crane in the side bay. Both of these cranes run the entire length of the shop. Two gib-column cranes of 2000-ton capacity are in the core-room.

The iron foundry is equipped with No. 3, No. 5, and No. 7 Whiting cupolas, having a capacity in excess of 150,000 lb. per heat. The air-blast is furnished by three Westinghouse centrifugal air-compressors with a capacity of 19,200 cu. ft. per minute. The amount of air is registered by two Clark blast-meters. Cinders and foundry waste are handled by a Link-Belt elevator-hoist to the disposal yard.

Castings leave the chipping-room on cars, cross a set of scales, and are delivered to the machine-shop casting-yard or loading-dock. The charging-floor is built of steel and concrete, covered with square wooden blocks set on end and wedged with asphaltum. Circulation of fresh cool air, combined with good light and plenty of room, make a perfect charging-floor.

In the iron and coke yards, which are on a level with the charging-floor, are concrete bins for storing molding-sand, pig-iron, and scrap. All material in the material yard is handled with a 20-ton electric locomotive crane, equipped with magnet. This crane does all the unloading

THE POWER-PLANT OF THE UTAH COPPER COMPANY

of material, handles the drop at the breaking-pit, and also handles the large boats into which the coke is loaded for delivery to the charging-floor.

The brass foundry is placed in a building separate from the iron foundry and is equipped with three oil-fired blast-furnaces, with a total capacity of 9000 lb. per day. Brass castings vary in size from a few ounces to 800 lb., and in quality from yellow brass to the best grade of bronze.

In both the iron and brass foundry castings are made by hand-molding, but most of the work is done by molding-machines of the latest type. Castings are not only made for the mills and mines and railroads of the Utah Copper company, but special machinery is made for the other associated companies. The production of castings has increased from a few thousand pounds per month in 1910 to 1,800,000 lb. per month in October, 1917. Up to January 1, 1919, there has been produced 70,000,000 lb. of castings. The working force in this department reached its maximum in October, 1917, when 240 men were employed.

The pattern-storage building is 126 ft. long, 64 ft. wide, and 41 ft. high; it consists of three floors equipped with pattern-racks. It is modern in every respect and approximately 10,000 patterns are kept in storage.

THE MACHINE-SHOP lies between the foundry on the east and the mill-building on the west. It is of timber and frame construction, 320 ft. long, 44 ft. wide, and 35 ft. high. The noteworthy feature of this building is its lighting arrangement, the entire structure being enclosed by continuous windows, which can be opened, thus giving perfect ventilation. The machine-shop floor is on the same level as the foundry. Castings from the foundry are either delivered direct into the machine-shop by service cars or are stored in the stock-yards and delivered to the machine-shop as required. At the west end of the shop are service-tracks connecting with the erecting or rigging sheds of the mill. Over these tracks is a 25-ton crane for handling castings direct into the plant or loading them on cars for shipment to the various plants. The heavy machine-tools of the Utah Copper company are in this shop, it being the intention to concentrate the heavy machining of all castings at this plant and then distribute them to the other plants as required. Approximately 75% of all machinery used in the construction and remodeling of the plants has been designed and fabricated in this shop. Machine-tool equipment is of the highest class and latest design, driven by individual motors. A clear aisle or runway space is provided through the shop. There are two electric overhead cranes, one of 10-ton and the other of 5-ton capacity. These cranes span the width of the shop and travel its length.

The blacksmith and boiler shops are under one roof, being an extension of the warehouse building. The floor of these shops is 10 ft. below that of the machine-shop. For the handling of heavy bar-iron and steel plate, there is a 5-ton hand-operated crane running the full length [illegible]. Both shops are equipped with modern tools [illegible] of doing the most complicated class of work

War-Time Coal and Coke

The coal bill was of dominating interest in the United States and elsewhere during the War, and it still commands wide attention. Studies of the prices of coal and coke from 1913 to 1918 were made by C. E. Lesher, of the U. S. Geological Survey, in co-operation with the United States Fuel Administration and the War Industries Board, and their results have just been published by the Survey as an advance chapter of its report on the mineral resources of the United States in 1918. Mr. Lesher's report shows that 80% of the bituminous coal produced in the United States goes to the railroads, public utilities, and manufacturing industries, which, taken together, represent a market that is little affected by seasonal changes, but that is subject to all the vicissitudes of business conditions—in prosperous and in dull times—that mark the ebb and flow of our industrial life. Of the remaining 20%, 4% represents exports—an item so small and local as to have no effect on the total—and about 16% is taken by domestic consumers, whose use of coal is of course seasonal. Bituminous coal is not stored except by the consumer, but moves directly from mine to user.

Conditions in 1917 and in the first nine months of 1918 were quite different from those in preceding years: demand generally exceeded supply and transportation was the principal factor limiting production. The general principles governing the prices in normal times continued to operate through 1916 and until the middle of 1917, although in the later part of this period conditions were far from normal. A tremendous increase in demand, which began in the last quarter of 1916 and extended through 1918 until the armistice was declared in November, brought forth an increase in production to a point where the limit of railroad capacity was temporarily reached with the demand still unsatisfied. Because the demand could not be fully satisfied, prices in the fall of 1916 and in 1917 rose to almost unheard-of figures, until first voluntary control and later Government control was exercised.

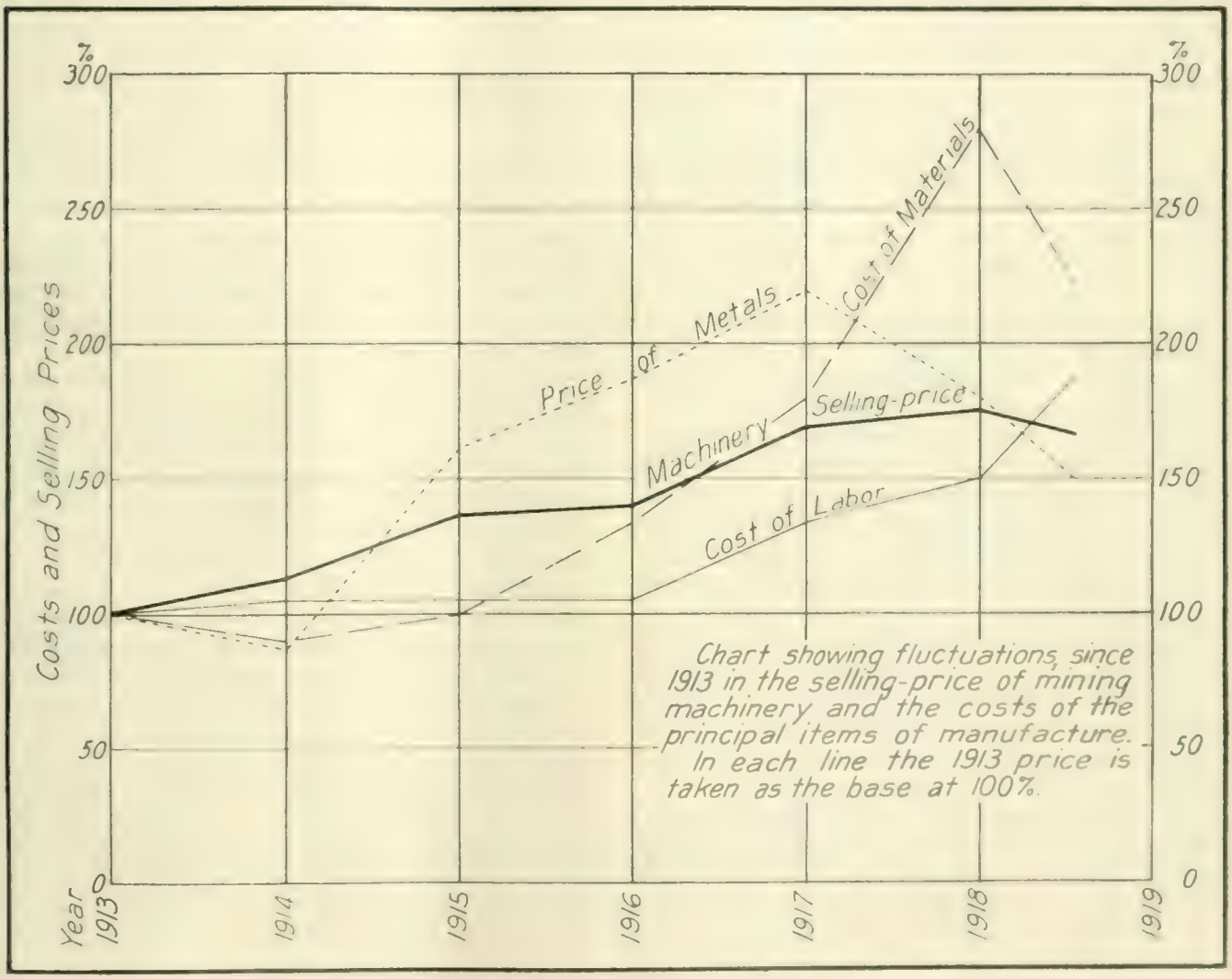
The history of the production of bituminous coal in the United States is a history of the growth of its manufacturing and other industries, but the history of the production of anthracite coal, nearly all of which has been mined in Pennsylvania, is conjoined with the history of the growth of population, for it is the fuel of the household. The anthracite mined in Pennsylvania amounts to only 15% of the coal produced in the country. The demand for anthracite of prepared sizes—egg, stove, chestnut, pea—represents 60% of the total output. For many years anthracite has been sold at a reduced price in summer to encourage its purchase and storage by the householder, and though these summer reductions are not accompanied by a reduction in the wage of the miners, the mining companies have found them very beneficial to the industry, because they permit more uniform operation of the mines throughout the year. The larger companies issue regular circulars giving prices

Selling-Prices of Mining Machinery Since 1913, with Accompanying Costs of Production

By A. S. BREAKEY

Not long ago the question arose as to the increase in the cost of mining machinery over pre-War prices, that is, since 1913. A short investigation proved that no such figures could be found; either they had not been compiled, or else such compilations as had been made were kept for private use. Accordingly I collected all the information available, including the costs of labor, metals, and the principal materials used in manufacturing such machinery, and made the accompanying chart. The machinery prices are an average of twelve standard appliances in use in mining and metallurgy, and were obtained from the leading manufacturers. The other costs were obtained from published quotations, supplemented by statements of the leading manufacturers.

In each case the costs for 1913 were taken as the base at 100%. It will be observed that, although the cost of materials increased to 280% of the 1913 average, and labor rose to 190%, with no present indication of stopping, the selling-price of machinery increased only to a maximum of 195.7%, with a decided drop so far in 1919. In these days of profiteers it is refreshing to discover at least one industry to which no such stigma can be attached. In addition, the manufacturers were handicapped by a decrease in the efficiency of labor as the wages increased.



Neither freight-charges nor overhead are included in costs. Both of these have increased appreciably, although not in the same proportion as the other items.

The metals whose selling-prices were averaged were copper, iron, steel, lead, spelter, antimony, and tin.

The Mackenzie River Basin, Canada

By F. H. MASON

An exceedingly interesting memoir has been published recently by the Canadian Geological Survey, entitled 'The Mackenzie River Basin' by Charles Camsell and Wyatt Malcolm. It is a compilation from books, pamphlets, and articles that have been published on the region since Samuel Hearne's narrative of his journey from Prince of Wales Fort to the northern ocean during 1769 to 1772—published in 1796—up to the present time; and it is enriched by Mr. Camsell's personal observations during his long residence in the region.

The Mackenzie is the second largest river on the North American continent. It is 2525 miles long; its basin has an area of 682,000 square miles and includes the northern part of the Provinces of Saskatchewan, Alberta, and British Columbia, the western part of the Northwest Territories, and south-eastern and south-western Yukon. It crosses 16 degrees of latitude, 53rd to 69th, and 36 degrees of longitude, 104th to 140th west.

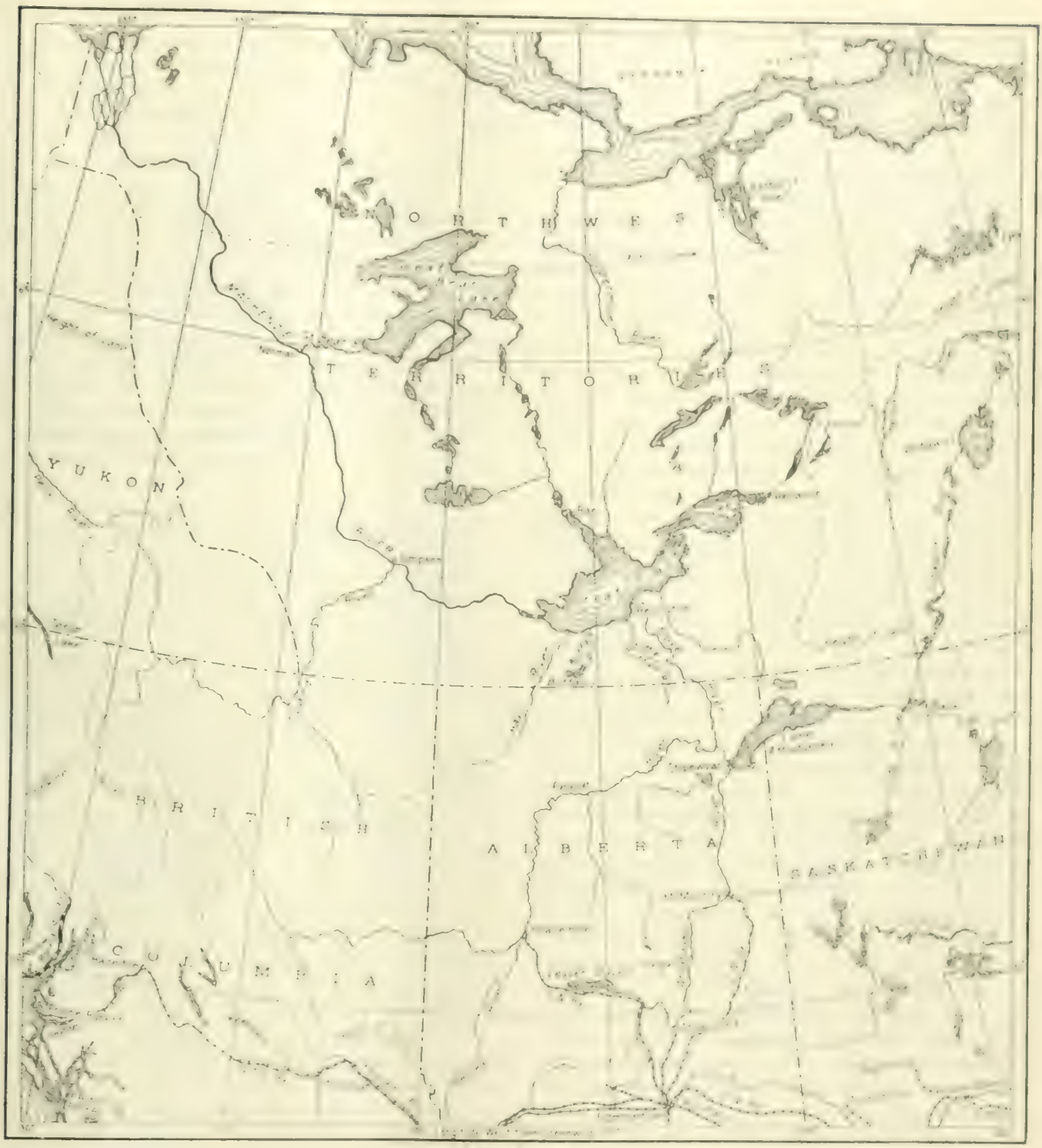
The memoir gives the history and bibliography of the region, and describes the rivers, lakes, agriculture, fauna, timber, transportation facilities, commercial possibilities, inhabitants, and general and economic geology of the explored parts. It comes with particular interest at the present time, when a number of geological parties are in part of the region exploring for oil, and when several big oil companies are attempting to obtain concessions from the provincial and dominion governments for exclusive oil rights over large areas of territory, as it gives an excellent description of the bituminous sand on the Athabaska river and its tributaries, and of such exploration for oil as has been conducted up to the present. It thus puts the layman *au fait* with existing conditions and giving him the opportunity of forming an opinion as to the advisability of the respective governments granting or denying the concessions requested.

It is generally supposed that the immense area of bituminous sand—estimated by S. G. Ellis, of the Department of Mines, at probably not less, and possibly much more, than 750 square miles—exposed on the banks of the Athabaska river and its tributaries and in other places, is an oil residuum saturating the sand, the lighter hydrocarbons having evaporated and the residuum having undergone a certain amount of oxidation. Assuming this theory to be correct, the question arises whether the overflow that escaped either through natural channels or a permeable stratum has exhausted the underground accumulation of oil, or whether there is still a large reservoir of oil somewhere below. To answer this question the governments, companies, and individuals at the present time have representatives in the northern parts of British Columbia and Alberta.

Besides the large area of bituminous sand on the Athabaska and its tributaries, isolated patches of similar material have been found over a wide area of northern Alberta. Detached pieces, weighing five to eight tons, were found on the west side of Buffalo lake, in Saskatchewan, but the deposit from which they came could not be found. The bitumen content of the sand varies from a small percentage up to saturation, and in some places the bitumen is found in pools, having separated from the sand during hot weather and collected in depressions near-by. Up to the present no means has been divesed of commercially separating the bitumen from the sand, and until this can be accomplished the material is of only local value. A portion of Kinnaird street, Edmonton, was laid with a pavement made from the Athabaska sand in 1915, and it is still in perfect condition, but, as the average bitumen content of the sand is 15% and as a bitulithic paving calls for 8 to 10%, it will be seen that for street-paving purposes the sand can have only local application. Its present use seems limited to the indication of better things below.

Other indications of oil and gas are found over a wide area of the region, principally in the sediments of Cretaceous and Devonian age. A spring of natural gas is situated at Tar island on Peace river about 25 miles below Peace River Crossing. The gas rises with salt water and some tar from among the gravel and boulders at the upper end of the island. The flow of gas was roughly calculated at 3 to 4 cu. ft. per minute. On Peace river and around Lesser Slave lake bitumen has been found in a number of places filling cracks in nodules, and a bitumen spring is reported near the mouth of Martin river on Lesser Slave lake. Franklin mentioned having observed a bituminous liquid trickling down a steep cliff on the north-west part of Garry island, at the mouth of the Mackenzie. Gas springs are numerous. The most important occur at the mouth of Little Buffalo river, a tributary of the Athabaska. The gas issues from the surface in numerous small jets, distributed over an area of 50 ft. or more in diameter. Some of the jets burn steadily when lighted, and give sufficient heat to cook a camp meal. Jets of escaping gas have been noted at many points on the Athabaska river.

To test the theory that oil would be found below the bituminous sands the Dominion government bored two wells. The one at Athabaska was sunk to a depth of 1770 ft., mostly through shale with occasional layers of sandstone. Several heavy flows of gas were struck, but no oil was found. The second well was sunk near Pelican river during the summers of 1897 and 1898. The following account is given: "The bituminous sands were met at a depth of 750 ft. They were found to consist of soft sand-



THE MACKENZIE RIVER BASIN

stone saturated with bitumen. Strong flows of gas were struck, and at 820 ft. a tremendous flow was struck, the roaring of which could be heard at a distance of three miles or more. The flow was so strong that no progress could be made with the drilling, and work was abandoned until 1898, when it was thought the force of the gas would be decreased sufficiently to permit further operations. But though there was a seeming decrease of pressure, upon operations being resumed in 1898 the seeming decrease was found to be in a great measure due to the closing of the outlet at the bottom of the casing by an asphalt-like mixture composed of maltha or petroleum tar and sand. In fact, when boring operations were resumed on June 17, the difficulty was found to be intensified by the accumulation of asphalt-like maltha in the bottom of the bore. The rapid expansion of gas produced a very low temperature, and this chilled and solidified the tar, or maltha, until it became as adhesive as wax. As the tools cut it loose the gas would carry it up through the bore, until from top to bottom it was almost

the mass of tar and sand. The only way it could be extracted from the sand-pump was by heating the latter over a fire; even then very little could be got out at one time, it being so thick that it was almost impossible to force it up into the pump. . . . By using a smaller casing the hole was carried to a depth of 837 ft., when another flow of gas was met, nearly equal in volume to that at 820 ft., and the work was stopped."

At Great Slave lake stratigraphic studies have shown a gentle anticline stretching across the lake from Pine point on the south shore to Nintsi (windy) point on the north shore. On Buffalo river and on Hay river above the falls structural conditions suggestive of gentle anticlinal folding are noticeable in the limestone outcrops. Exposures are confined to the valley floors where the rivers have cut down into the Devonian sediments.

Thus it will be seen that, although the results so far obtained have not been over-encouraging, the field is so vast and the reward for success so great that the region would seem to warrant the attention it is receiving.

Turning to the nickel outlook, considerable excitement was caused by the discovery of nickeliferous sulphides in 1914 at the east end of Athabaska lake. The geology of this region has been studied by J. B. Tyrrell and F. J. Alcock, and in 1915 Charles Camsell made an examination of the claims that had been staked for nickel. Norite, which is the nickel-bearing rock in the Sudbury region, occupies the area between the gneiss and the sandstone on the north side of the lake. It extends from the mouth of the Robillard river to the east end of the lake. It is distintely foliated, and is cut by many small irregular veins of quartz. Practically all the claims that have been staked are in the norite, and, with the exception of the contact phase of the sandstone and some of the dark bands in the gneiss, this is the only formation that shows any evidence of important mineralization. Bunches of weathered ore are found at wide intervals, the minerals consisting of pyrrhotite, chalcopyrite, arsenopyrite, and pyrite. The sulphides are not massive. They are isolated from each other, but by following the strike of the foliation of the norite another body may be found several hundred feet away. Quartz stringers, two to six inches wide, cross-cut the formation, and in these the principal sulphide is arsenopyrite. Sometimes pyrite, galena, and specularite also occur. Deposits of this character are found in several places in the belt of norite lying between Sucker bay and North bay and extending along the strike of the norite from the islands about channel point north-eastward for several miles inland. The sulphides contain nickel and copper, and platinum is reported to have been found, but up to the present the metal content invariably has been low, and, unless more important discoveries are made, the remoteness of the district from railway transportation and from centres of population and the present undeveloped state of the surrounding country seem to make the exploitation of these deposits impracticable at the present time.

Like oil, nickel, it will be seen, has so far been discovered only in small quantities in this region. The only mineral that occurs in really important quantities is coal. Coal is found in the Cretaceous formation in the southern part of the basin and in the Tertiary in the northern. It occurs as lignite, bituminous coal, and semi-anthracite. The seams range from a few inches up to thirty feet in thickness. A colliery is being developed at Telkwa and is supplying the Grand Trunk Pacific railway. This is using coal instead of oil on all trains east of Prince George. Exposures of high-grade bituminous coal occur on the banks of Hay river, Smoky river, Sheep creek, and other streams, and a seven-foot seam of semi-anthracite is exposed on Smoky river. Two to three-foot seams of lignite occur in the McMurry sandstones, and numerous thin seams of lignite have been found in Peace River canyon. A 30-ft. seam of lignite is reported by Camsell on Bonnet Plume river, in the Peel River basin. Several seams, running from two to nine feet, are reported by Joseph Keele to occur on the Mackenzie at the mouth of the Great Bear river, and MacFarlane reports coal resting on limestone at the junction of the Lockhart and Iroquois rivers.

THE MOVEMENT for Federal endowment of engineering and industrial research was revived early in the present Congress by the introduction of two bills into the Senate. The first bill provides for the establishment of an engineering experiment station in each State under the direction of and in connection with some university, engineering school, or land-grant college. The State legislature of each State is authorized to designate the institution best equipped to conduct the work, but wherever the land-grant college has facilities approximately equal to those of the other institutions of the State, it shall be designated. All designations of institutions are made subject to the approval of the Secretary of Commerce. He is authorized to secure practical uniformity of methods, and efficient and economical expenditure of funds by indicating such lines of work as shall seem to him important from a military, naval, industrial, or national standpoint; but the responsibility for the initiation and conduct of research shall rest with the individual engineering experiment stations. The second bill sets up the Secretary of Commerce and the National Research Council as a 'National Board on Engineering and Industrial Research', which shall appoint in each State and territory a State research board to consist of five engineers or scientists. It shall be the duty of each State board to supervise and control all engineering and industrial research undertaken under the provisions of the Act, which shall include among other subjects those having to do with engineering, chemical, physical, and economic problems connected with water supply, sewage treatment and disposal, industrial wastes, flood protection, drainage and irrigation of land, transportation of property and persons, public lighting and heating, power development and manufacturing processes. Each State board shall utilize such laboratories, equipment, and individuals as may be available in connection with any institution of learning within the State or territory, but before authorizing any investigations report shall be made to the Secretary of Commerce and authority to proceed shall be secured from the national board.

The New Elmore Process

*The new process invented by F. E. Elmore for dealing with mixed sulphides is described in his British patents 6546 and 11,348 of 1917, consolidated into patent 127,641. The patent has been acquired by the Chemical & Metallurgical Corporation, which has a nominal capital of £1,200,000 divided into 200,000 8% cumulative preferred shares and 1,000,000 ordinary shares of £1 each. The chairman of the company is Mr. Herbert Guedalla, of the Imperial & Foreign Corporation, and he is supported by a number of men honorably prominent in mining affairs, namely, Messrs. A. Stanley Elmore (brother of the inventor), J. A. Agnew, F. W. Baker, H. F. Marriott, and Walter McDermott, who has been a strong supporter of the Elmore brothers in their oil-flotation business. Details of the process, extracted from the complete specification, are given in the following paragraphs.

This invention relates to the extraction and separation of lead and zinc from ores, concentrates, and the like, in which these metals exist associated together in the form of sulphides. The invention consists in treating the ore, concentrates, or the like with certain acid agents whereby the lead sulphide is converted into a soluble lead compound while the zinc sulphide remains substantially unattacked. The acid agents in question are sulphuric acid alone or a solution of a suitable salt to which has been added either sulphuric acid, hydrochloric acid, or an alkali bisulphate. Suitable salts are sodium chloride, ammonium chloride, or other halogen salt (other than that of a heavy metal) capable like these of acting in solution as a solvent of lead sulphate or chloride.

If finely ground galena be heated at about 100°C. with concentrated sulphuric acid (specific gravity about 1.84), the sulphide of lead is converted into sulphate. With proper adjustment of conditions, such as fineness of grinding, proportion of sulphuric acid, temperature, and time of contact, substantially the whole of the sulphide can be converted into sulphate. The latter compound may then be dissolved, for instance in a hot saturated solution of sodium chloride, and thus separated from any insoluble matter. On the other hand, if zinc-blende be heated witth the concentrated acid at a temperature of about 100°C., only a relatively small amount of the zinc is converted into sulphate, the major portion remaining insoluble in hot brine. If, therefore, the two sulphides be present in an ore or concentrate the lead and zinc may be separated in this manner.

According to one form of the invention the finely ground ore containing the sulphides of lead and zinc is heated with a sufficient quantity of concentrated sulphuric acid at a temperature of about 100°C., until substantially the whole of the lead has been converted into sulphate. The product is washed once or twice with water to remove practically the whole of any remaining free acid, and to the residue is added a hot, strong, preferably saturated solution of sodium chloride. The sulphate of lead dissolves readily in the hot brine and may be separated by filtration, decantation, or otherwise from the undissolved matter containing the zinc sulphide. The hot brine is then cooled, whereupon any excess of lead salt over that which the cooled brine can hold in solution will be precipitated and can be collected for use in any known manner, while the brine is reheated to be used again. The brine may thus remain in circulation in the process.

Example I. A lead-zinc sulphide ore from Burma containing 23% of lead and 40.5% of zinc is ground to pass through a 60-mesh standard sieve. Twenty kilogrammes of the powder are mixed with 20 litres of sulphuric acid of 1.84 specific gravity in a lead-lined steam-heated vessel, and the mixture is heated at about 100°C., until the evolution of sulphur di-oxide has practically ceased. Water is now run into the vessel, the mixture well stirred and allowed to settle; the water is run off, and this washing operation once repeated. One hundred litres of a saturated solution of common salt are now run into the vessel, the contents of which are well stirred and maintained at 100°C. for, say, half an hour, whereupon the undissolved matter is allowed to settle and the hot solution run into a cooling-vat in which a mixture of lead sulphate and chloride separates from the liquid and may be collected for metallurgical treatment. The residue in the heating-vessel may be washed first with brine and then with water, if desired, and metallurgically treated for recovery of zinc.

If, instead of sulphuric acid of 1.84 specific gravity, a less concentrated acid be employed, the lead can be converted into lead sulphate, but a larger proportion of the zinc may be in this case converted into zinc sulphate. In deciding whether to use concentrated or weaker acid, practical considerations such as the value of zinc and the cost of the different grades of acid must be taken into account. On using concentrated acid or somewhat weaker acid, the reaction upon the lead sulphide is accompanied by an evolution of sulphur di-oxide and the production of free sulphur. With still weaker acids, however, the reaction is accompanied mainly by the evolution of sulphuretted hydrogen. In whatever form sulphur is liberated, it may be used in the known manner for producing sulphuric acid. By working separate batches with strong and weak acids respectively, it is possible, as an alternative to using the sulphur di-oxide and sulphuretted hydrogen directly in the known manner for the production of sulphur or sulphuric acid, to lead the sulphur di-oxide liberated from the strong-acid

*Abstracted from the August issue of 'The Mining Magazine'.

batch into the weak-acid batch, whereby the objectionable emission of both sulphur di-oxide and sulphuretted hydrogen may be largely abated.

According to another form of the invention, the finely subdivided ore is treated with an acid in presence of a salt, such as sodium chloride. A weaker acid may then be used. Thus, the finely subdivided ore may be treated with hot strong brine to which sulphuric acid has been added.

Example II. Twenty kilogrammes of the ore referred to in Example I, crushed to pass through a 100-mesh standard sieve, are stirred in an earthenware steam-heated vessel with 100 litres of a saturated solution of common salt and the mixture is heated to about 85°C. Six litres of sulphuric acid of 1.84 specific gravity are gradually run into the vessel, the heating being continued. The lead sulphide is attacked, the lead passing into solution, while the zinc sulphide remains substantially insoluble. When the evolution of sulphuretted hydrogen has practically ceased, the hot brine is separated from the insoluble matter and is run into a cooling vat, where it deposits lead salt; it may be re-heated to be used again.

When the acid agent is hydrochloric acid in presence of a suitable salt solution, lead chloride is formed and sulphur is evolved in the form of sulphuretted hydrogen.

Example III. Twenty kilogrammes of the finely subdivided ore referred to in Example I are stirred in an earthenware steam-heated vessel with 65 litres of a saturated solution of common salt, the mixture being heated to about 80°C. Eighteen litres of hydrochloric acid of specific gravity 1.11 are now run in, and stirring and heating continued until evolution of sulphuretted hydrogen has practically ceased. After settling, the hot brine is run into a cooling-vat where the lead compound crystallizes. The brine may be used again.

Example IV. Twenty kilogrammes of Broken Hill concentrate containing 44.2% of zinc and 9.2% of lead, and capable of passing through a 30-mesh standard sieve, are mixed in an earthenware steam-heated vessel with 120 litres of a saturated solution of common salt to which 27 kilo. of sodium bisulphate ($NaHSO_4$) have been added. The mixture is boiled until the evolution of sulphuretted hydrogen has practically ceased. The hot brine is then separated from the insoluble matter and is run into a cooling-vat where it deposits lead salt; it may then be reheated to be used again.

If it is more convenient under local conditions to smelt lead sulphate than lead chloride, it is preferable to convert the latter into sulphate by heating it with strong sulphuric acid, whereby hydrochloric acid gas is evolved; this is absorbed in water or in brine in such manner as to form either a strong aqueous solution of acid or a solution of the acid in brine. The aqueous solution may be mixed with brine to render it suitable for treating a further batch of ore; the solution of the acid in brine is already suitable for this purpose.

The lead sulphate, whether made directly from the ore or from the chloride, may be mixed with lead sulphide and smelted in known manner, and the lead sulphide, or a part of it, necessary for the purpose may be made by utilizing the sulphuretted hydrogen from the treatment of the ore with hydrochloric acid and a salt solution.

The following are the claims:

1. The treatment of lead-zinc sulphide ores, concentrates, and the like, consisting in treating the ore with an acid agent as herein defined, whereby the lead sulphide is converted into a soluble lead compound while the zinc sulphide remains substantially unattacked.

2. The treatment of lead-zinc sulphide ores, concentrates, and the like, consisting in heating the ore with strong sulphuric acid at about 100°C. until substantially all the lead sulphide has been converted into lead sulphate, dissolving the latter with a hot strong solution of sodium chloride or other suitable halogen salt, separating the hot solution from the unattacked zinc sulphide, and cooling the solution to cause a partial crystallization of lead salt.

3. The treatment of lead-zinc sulphide ores, concentrates, and the like, consisting in heating the ore with a strong solution of sodium chloride or other suitable halogen salt to which a sufficient quantity of sulphuric or hydrochloric acid or an alkali bisulphate is added, whereby the lead is caused to pass into solution while the zinc sulphide remains substantially unattacked, separating the hot solution from the zinc sulphide by filtration, decantation, or the like, and cooling the solution to cause a partial crystallization of lead salt.

4. In the herein described treatment of lead-zinc sulphide ores, concentrates, and the like, for the separation of the lead from the zinc, heating a mixture of one portion of the ore with sulphuric acid of a strength adapted to evolve sulphur di-oxide, heating a mixture of another portion of the ore with acid adapted to evolve sulphuretted hydrogen, and passing the gases evolved from the first mixture into the second, substantially as and for the purpose described.

5. In the herein described treatment of lead-zinc sulphide ores, concentrates, and the like, in which the lead compound produced contains or consists of lead chloride, heating the said compound with strong sulphuric acid and absorbing in water or brine the hydrochloric acid gas evolved, substantially as and for the purpose described.

6. Smelting the lead sulphate produced by the treatment referred to in Claim 5 with lead sulphide so as to produce metallic lead.

7. The treatment of lead-zinc sulphide ores, concentrates, and the like, consisting in heating the ore with an acid agent as herein defined, which converts the lead sulphide into a soluble compound while substantially not attacking the zinc sulphide and causes evolution of sulphuretted hydrogen, utilizing the sulphuretted hydrogen to make lead sulphide from the soluble lead compound, and smelting the lead sulphide together with lead sulphate so as to produce metallic lead.

8. The treatments of lead-zinc sulphide ores described in the several examples herein.

REVIEW OF MINING

ARIZONA

GENERAL NEWS OF THE STATE

CLIFTON.—A special meeting of stockholders of the Shannon Copper Co. was called for September 24 to decide whether the property should be sold to the Arizona opper Co., under terms of an offer made by the latter orporation. The Shannon ceased operation in all divisions several months ago. The resolution to be voted pon authorized the sale of all shares in the copper propty at Clifton, the Shannon Arizona Railway Co., Clifton Northern Railway Co. and Colorado Mining Company.

TUCSON.—Fuel-oil burners of Arizona, including representatives of all the large mining corporations in the tate, met here September 19 to protest against any increase in rail-rate upon fuel oil from the Texas fields, hich is considered in order to equalize the rate from alifornia. The argument of the consumers was that alifornia companies find themselves unable to keep up ith the demand, while Texas, with its new wells, is in position to do so easily. The members of the State orporation Commission, the rate-fixing body, were in attendance. Decision was reserved. If present rates on Texas oil can be maintained, a saving of millions of dollars annually will be possible, according to mining men.

WILLCOX.—The Central Mining Co. has been organized to work a group of sixteen claims, 18 miles west of this place, in the Dos Cabesas district, and adjoining the Mascot company, which last year was an important producer. The surface showing on the property is exceptionally good. E. A. Ely is in charge of the work. The Central Copper property is served by the branch of the Southern Pacific railroad that was built several years ago to serve the Mascot. Los Angeles interests recently acquired a bond and lease on the Dives group in the same vicinity and development work has been started on a moderate scale. John Welty is operating a small mill on the Bane mine with good results. The Sunset group has been bonded to Montana interests which are reported to be planning extensive development.

GLOBE.—The Miami Copper Co. has received its new electric hoist for its No. 5 shaft and erection has been started. The shaft-house, head-frame, and retaining-wall are well under way. The new hoist is of the geared type, 250-hp. motor, the load being balanced by a 10,000 lb. counterweight. Production of the mine and mill is about two-thirds capacity. Sinking the shaft at the Van Dyke Copper Co.'s mine continues at the rate of about four feet daily. It is the intention of the management to sink 1300 ft. before starting lateral development. This should put the shaft through the orebody at the northern end of the property, which was discovered by drilling at the approximate depth of 1170 ft. Exploration of this body from the 1300-ft. level is planned. The new concentrator of the Gibson Consolidated now is milling approximately 100 tons of ore daily. The company has ordered a thickener for the more efficient reclamation of water. As soon as the thickener is installed a third shift will be put to work. Ore from the dump to the mill is being handled from the surface, instead of being run down raises to pockets and then hoisted through the main shaft as originally planned. This scheme has been found more economical. Regular shipments of six carloads of concentrates daily are being maintained. The International smelter recently blew in its third reverberatory furnace and now has a production of 300 tons of copper matte per day. The last of the surplus stock of copper accumulated since the Armistice was shipped early in the month and marks the cleaning up of surplus stock of copper in the district. The smelter is gradually constructing its new dumping-ground for the disposal of slag. Grading and track laying as well as building a high fence along the highway have been completed. The new dump will afford facilities for twenty years, and also will eliminate danger due to dumping slag on unconsolidated tailing, which is the present practice.

Churn-drill operations at the Castle Dome have been hampered by the breakage of drilling tools in No. 6 hole, due to the exceptional hardness of the strata. The new equipment of the Iron Cap is in successful operation. This includes a hoist and conveying system. The hoist, 250-hp. electrically-driven, is able to handle 400 mine cars of ore in five hours, or at the rate of 80 tons per hour. Shipments of low-grade copper, averaging 5%, are being made to the International smelter, with 8% ore or better is being shipped to the smelter at El Paso.

JEROME.—Fifty feet of schist, impregnated with pyrite and some chalcopyrite, has been cut by the diamond drill operating on the 500-ft. level of the Pittsburg-Jerome. The farther wall has not been reached. While no ore has been struck, the showing is considered highly encouraging by Richard L. Smith, consulting engineer, who has been inspecting the property. The hole is a flat one, being drilled south and west from the 500 ft. level into territory never before penetrated. Probably steps will be taken to run a cross-cut from the [illegible] level to intersect the schist located by the drill. The cross-cut would intercept the ore 450 ft. below the hole. Cores from the drill hole are said to be identical with the for-

mation now being developed at the Verde Combination.

NOGALES.—Charles M. Schwab is reported to have bought the mineral rights of the Baca Float, including some exceedingly rich resources developed by old mines not now working. Mr. Schwab is not a newcomer in the South-West, as he has a number of profitable investments, including a property in Mexico, across the line from Hachita, New Mexico. Louis J. Merritt of Pasadena, California, is inspecting the Tres de Mayo mine, owned and operated by the Bachmann-Merritt Mines Co., of which he is vice-president. He is accompanied by O. B. Bachmann, who is devoting considerable time to direction of the company operations. A 12-ft. vein of vanadium, said to carry approximately 25%, has been discovered on the property. Parallelling the vanadium is a vein of silver ore stated to be worth $50 per ton. Arrangements are being made for the shipment of vanadium to Eastern points and it is probable arrangements will be made soon for the concentration of the silver ore.

CALIFORNIA

GRASS VALLEY, NEVADA CITY, SIERRA COUNTY.

GRASS VALLEY.—Owners of lands in the Alta Hill district, north-west of the city, are finding a ready sale for their mineral rights. Roy King, a mining engineer, said to represent Tonopah interests, is securing the options by making a small cash payment, which will be followed with a larger one next year. This district was famous in the early days for its placer gold but has been practically idle for many years. No veins appear on the surface and hope of future mining is simply based on geological conditions. A tunnel of considerable length that was driven years ago will be extended into the hill. Recently the Highway Mining Co., operating on the Morandi tract near town, uncovered a vein of quartz from 8 to 10 in. wide showing gold. Prospecting still continues. A satisfactory test of the pumping machinery of the Idaho-Maryland was made recently. A Cornish pump will be used until the complete electrical installation arrives. This shaft is 1000 ft. deep and unwatering will require a long time.

NEVADA CITY.—After years of persistent effort gravel was found recently in the Lost Channel claim near Banner. The tunnel is in over 200 ft. G. M. Hoff and others hold a bond from the Ahern brothers. On the theory of an old miner that the ground should contain gravel, tunnels have been run for years on both sides of the ridge. This is the first proof of the correctness of the theory. Information of a rich and extensive find of ore in the Champion mine has just reached the public. While the full extent of the body is not yet known, the promise is made that should it extend to a lower level the company will make improvements in proportion to its value, one of which will be sinking the main shaft 1000 ft. The find is the most important in years and comes most opportunely, for the Champion has been on the verge of closing down for a long time—the last during the threatened strike in June. Although no figures of tonnage or grade have been made public, enough is known to encourage the owners in their belief that years of prospecting are about to be rewarded.

SIERRA COUNTY.—The Columbia quartz mines near Ormonde have closed down because of the difficulty in keeping a full crew. J. L. Whitney is superintendent.

PLACER COUNTY.—Preparations are being made to continue operations all winter at the Canada Hill mines. They are at an elevation of 5500 ft. Buildings are being erected to withstand the snows. The management is in charge of H. J. Snyder, who has spent several years in consolidating some fifteen claims, all of which were turned over to the Metals Exploration Co. of New York. While the claims have been but little developed from the surface, a number of promising veins run through the property. A long tunnel will be run to intersect them and prove their value.

GRANITEVILLE.—Cushman and Adams of San Francisco have a bond from Samuel Colt on the Spotswood quartz claim and in driving the continuation of an old adit made an important discovery a few days ago. The ore was stated to be liberally sprinkled with gold. Whether the discovery was merely a pocket or will lead to an orebody is not yet known.

COLORADO

TELLURIDE AND RICO.

TELLURIDE.—A shortage of miners continues, and 300 to 400 men are needed to carry out prospective developments. Although shipments from the district are not heavy for this time of year, there is no doubt that production during the coming year will be substantially increased. The Silver Canon Mining Co. has opened up a good vein of silver-lead ore, in the Shamus O'Brien, 18 in. wide, with a fine showing of native silver and gray copper. The workings are being re-timbered, and the operators are getting the mine into condition as a producer. One of the most interesting haulage feats undertaken by the Telluride Transfer Co., which makes a specialty of such operations, is the transfer of a ball-mill from the railroad to the new flotation plant of the Tomboy Gold Mines Co. The mill is 9½ ft. in diameter and weighs about 9 tons. Six horses pulled, and four were hitched to a push pole at the rear of the wagon. Three days time was required to cover the entire distance, the road being in an especially unfavorable condition and very muddy. Often the truck was buried to the axles. The Japan-Flora Mines & Tunnel is involved in litigation, owing to a suit being brought by the Lawrence Savings & Trust Co., of New Castle, Pennsylvania, to recover payment due on principal, bond, and interest, due as underwriters for a bond issue. The amount is $300,000. The Matterhorn company has started a mill-run on the Dewey ore, at the Butterfly mill, and will start shipments of concentrate at an early date. The product is expected to be similar to the Old Butterfly-Terrible concentrate, which carried considerable iron and high gold and silver. There is a report to the effect that the Liberty Bell Gold Mining Co. is about to close down. Up to the present time no confirmation of this report has

been received. During August a few cars of clean-up were shipped. A mill will be built at the New Dominion mine situated at Ophir. The Gold Run Mining Co. has been organized to work over the sands of the River Bed at Pandora, to recover metal in the tailing from the Smuggler and Tomboy mills, a mill is already in operation with three shifts under electric power. The new company is capitalized at $50,000, backed by a strong organization of mining men of the district. The operations of the Valley View Leasing & Mining Co., leasing the San Bernardo, are progressing rapidly. A force of men is at work re-timbering, cleaning out, and widening the tunnels to facilitate the movement of the ore. A tramway from the working tunnel to the mill-site is also being built. While the mill is under construction crude ore will be shipped from Tunnel No. 4, where there is a good body of ore yielding assays as high as $75 per ton the ore containing gold, silver, lead, and copper. The ore in the San Bernardo justifies extensive development and a profitable run is forecasted for the new company. The new mill will be three stories in height, size 30 by 50 ft.; the lower floor will accommodate storage-bins and the crushers; the second floor, flotation mills and the grinders; and the top floor Wilfley tables. The tramway from the working tunnel to the mill will move the ore at a minimum cost. Herrington & Co. are cleaning up the old mill of the Smuggler Union, making a good recovery from the tailing and screening. A number of cars of the material have brought the lessees returns of about $2000 per car, as the material ran over 3 oz. in gold and $30 in silver. The Smuggler Union has a run of high-grade silver ore on the Humboldt, and is producing a concentrate carrying 350 oz. of silver per ton.

Rico.—Mining operations are going on at more properties than for some years past, and there will probably be a number of producing mines during the winter months. Much development that has been under way for the past year is nearing completion, and some of the operators are already in condition to ship. Owing to a lower grade of ore encountered the Marmatite company has temporarily ceased to ship, after averaging 25 cars monthly during the past 5 months. Development of the Silver Swan continues; work on the Pro Patria is progressing, and the company expects to make shipments of lead and zinc ore at an early date. A good showing of lead-silver ore is reported. The Rico Argentine Mining Co. has resumed operations, and will probably ship during the remainder of the year. A compressor is being installed. Operations on the Premier Claims are progressing; the new tunnel has been driven 110 ft. and is now in the Old Shively workings. The Home tunnel is being opened up and re-timbered. There will be a raise to the upper workings to permit better ventilation. The Rico Wellington Mining Co. is now completing two years of development work and is in readiness to produce a heavy tonnage from the lower workings, but may await a better metal market before starting shipments. A branch tramway from the main tramway to the Mountain Spring tunnel is now under construction, and when completed will facilitate the movement of the ore and decrease operating costs. Ore will be moved from the lower levels by an elevator hoist. The drive to the Leap Year fissure is nearly completed, and a large body of high copper ore has been developed. The St. Louis and Bancroft claims have been leased to Nutter & Co. The Mediterranean mine is packing out ore to make a carload shipment. The Syndicate company intends to drive the Potter tunnel an additional 100 ft. Shipments of silver ore have been made and a good vein of lead-zinc ore has been opened. The Schooto claims are under lease

A VIEW OF THE SMUGGLER UNION MINE, TELLURIDE

to R. L. Pellet. Among the preliminary operations will be re-opening the shaft, and sinking to a sufficient depth to discover whether or not the Newman Hill contact continues south of the Deadwood fault. Emmet Nutter has taken over the Iron Mine group, consisting of the following claims: Iron Mine Lode, Uncertainty, and Lucky Number, in the Pioneer Mining district, under a bond and lease from the owners, Matt Jacobson and Henry Obendorfer. The price of the property is $15,000. The J. M. Doyle Mining Co. has been organized to develop the property, and extensive operations are now under way. A tunnel is being driven on the Missouri lode to tap the main orebody of the Iron Mine Lode.

MICHIGAN

EFFECT OF STRIKES.—THE METAL SITUATION. OPERATIONS AT THE MINES.

HOUGHTON.—The steel industry strike did not make any difference in the operation of the copper mines of Michigan and is not likely to. The strike of lake seamen was looked upon as possibly making some trouble for the copper mines, but a careful examination of the situation shows that the copper mines already are supplied with the coal necessary to keep the mines working until next July, a condition applicable to all the larger properties and most of the smaller ones. Mines here import coal by water early in the summer. Of course the steel strike may indirectly have some bearing on the copper industry by creating a further slackening in the demand for the output of mines.

Frankly the metal situation, as viewed from the standpoint of Michigan producers, is not good. There is today 50,000,000 lb. of copper on hand at the docks and in smelter yards. At the Dollar Bay yards of the Lake Superior Smelting Co., owned jointly by the Calumet & Hecla, Isle Royale, and Osceola corporations, there is 12,000,000 lb. of refined metal. The metal has been there since last spring when the plant shut-down. The plant may never be re-opened, because the Calumet & Hecla can handle its entire smelting operations more economically at the main smelter at Hubbell, and it is bad economics to maintain two such plants. The fact that such a large amount of refined copper has not been sold indicates that this company is carrying a substantial amount on hand against the foreign demand that is expected when the peace arrangements are satisfactorily completed. Michigan copper mines are continuing to engage more underground men, but they all are working on new development, preparing for future demand rather than attempting to increase present production.

Geologists generally will be interested in the knowledge that the whole Michigan district is to be given a thorough geological examination under the direction of L. C. Graton. Messrs. Lock, Burns, and Polache of his staff are already on the ground. Practically all mineral development that has been made in this district has resulted from discovery of copper accidentally or from following the extensions of proved veins on adjoining properties. The Calumet conglomerate lode, which has paid more millions than any other copper formation in the world, was found by plain good luck. The original copper deposit was mass stuff, hidden by prehistoric races. When this was removed it was found resting on the outcrop of what is now the Calumet conglomerate. That formation runs for 34 miles, from Calumet to the very end of Keweenaw Point. It was identified in the Clark property, the farthest north point of the peninsula, without copper; in the Delaware property with a little copper; at the Allouez at Ahmeek properties and presumably at the Tecumseh and Franklin without copper. The Calumet & Hecla is now having this geological examination made in order that its future exploratory work may be on a sound foundation of geologic fact, rather than the haphazard methods that have obtained in the past in so much of the district.

Wolverine operations are now confined to eight levels in the lower limits of shafts 3 and 4, back of the footwall. High-grade ore is being hoisted from the lower levels, but the upper level openings are showing only a small profit. The Mayflower shaft is now down 1510 ft. in trap and amygdaloid. Calumet & Hecla is operating two shifts daily on all shafts on the conglomerate lode and on two shafts working on the Osceola amygdaloid. It is reported that the Lake mine may be re-opened in 60 days. The White Pine in Ontonagon county is adding to its working forces regularly. Calumet & Hecla is making a survey of its smelting necessities before determining the extent of remodeling to be done. The experiments with electric smelting of copper have not been satisfatcory.

NEVADA

GOLDFIELD DEVELOPMENT CO. TO RE-TIMBER SHAFT.—CONDITIONS ARE PROMISING IN THE SIMON DISTRICT.

GOLDFIELD.—The Goldfield Development Co. will enlarge the main shaft slightly and completely re-timber it from the surface to the 380-ft. level. The timbers will be 10 by 10 in., which will permit increased hoisting speed and add 20% to the capacity of the shaft. This was decided after it had been determined that 150 ft. of the shaft would have to be re-timbered. The Atlanta is repairing and cleaning the 1300-ft. east hanging-wall cross-cut on the 1465-ft. level of the Grizzly Bear shaft. Driving will be started south-east in a seam of low-grade ore near the face of the cross-cut. The Kewanas is driving south on the 700-ft. level in a vein containing low-grade ore. A cross-cut is being driven north-east on the same level. This work is being done in the northern part of the claims. The Blue Bull is cross-cutting east on the 250-ft. level to open the extension of narrow seams of ore found in a raise from this level. The Merger has stopped work through the Spearhead shaft, where the shale-latite contact was being explored from the south drift on the 910-ft. level of the Spearhead. The Merger is now inactive. The south cross-cut on the 815-ft., or bottom level, of the Grandma has entered the shale. One foot of ore assaying $40 was found on the shale-latite contact and driving has been started at this point. The cross-cut first entered highly silicified shale, fractured and with frequent intrusions of latite, and the primary blue shale was not found until this material had been penetrated for 40 ft. The shale was found dipping east and it is believed to mark the true contact entering the Grandma from the Lone Star and Blue Bull. The Grandma shaft entered a hill of shale and prospecting in all directions from the shaft failed to disclose the shale at another point until it was found in the south cross-cut. Lying on the shale is a mass of quartz 100 ft. thick, known as the Spearhead-Grandma vein, in which the Spearhead has opened small ore-shoots on the upper levels. The $40 assay secured by the Grandma is the highest ever obtained by this company. The Reorgan-

ized Diamondfield Black Butte Mining Co., which has been inactive for a long period, is to resume work on the claims owned by the company in the Diamondfield district, four miles north of Goldfield. J. K. Turner, consulting engineer, expects to do the first work through the old Dortch lease shaft, where a crosscut will be driven on the 190-ft. level to open a wide vein striking southeast, the outcrop of which is evident near the black butte from which the name of the company is derived. Many thousands of feet of development work and stoping was done in the Black Butte in the early days of Goldfield, when a good production of high-grade ore was made, both by the company and lessees. The formation in the Diamondfield district is similar to that of Goldfield. The Reorganized Black Butte owns the Orizaba, near Cloverdale.

Simon District.—Walter Harvey Weed recently examined the Simon silver-lead mine and in conversation commented favorably on the mine and the district. Nine hundred feet south-east of the main shaft a vein 22 ft. wide has been opened on the surface and ore has been exposed for this width. A 5-ft. width assays from 40 to 50% lead. This is taken as an indication that the main vein of the district contains ore for a distance of 1000 ft. in the Simon claims. A new gasoline-driven surface plant, capable of hoisting from 1400 ft., has been erected and sinking the shaft an additional 200 ft. from the 400-ft. level is to be started immediately. Drifts and crosscuts are being driven on the 300 and 400-ft. levels to block out ore and explore the vein farther to the southeast and also into the hanging wall. Ore assaying from $35 to $50 at present prices has been found in the 40-ft. shaft of the Simon Fagan, the value being principally in silver and lead, with a small gold content. The Simon Fagan is sinking in the main Simon vein.

West Divide.—The north drift of the West Divide Mining Co., at a depth of 60 ft. has been driven 42 ft. and the face is in ore assaying from 50 to 125 oz. silver. At 35 ft. the vein became spotted with lime and this condition continued for 4 ft. The ore is now 3½ ft. wide and is being saved for shipment as soon as the Tonopah-Divide strike situation clears and more men can be put to work. It will be necessary to repair the road to Goldfield before shipments can be started. A drift south has been started in a narrow vein of ore, the same condition that existed when the north drift was started.

Montezuma.—The south drift on the 100-ft. level of the Monitor group of claims has been driven 64 ft., 19 ft. with a full face of silver-lead ore assaying from $75 to $100 per ton. The lower half of the drift is in practically solid lead sulphide ore. Ore assaying $75 has been exposed on the 50-ft. level for a distance of 15 ft. in the same shoot, which extends to the surface.

Gold Mountain.—The surface of the claims of the Washington Gold Quartz Mining Co. are being prospected and, according to J. K. Turner, general manager, high assay returns are being secured. A well defined contact between granite and porphyry is being explored and it is believed by Mr. Turner that this will result in a new shaft being sunk on the contact. The former owners did no work on the contact but recent work has shown the best possibilities for opening orebodies to be at this point. The ore is lead carbonate and sulphide and contains gold and silver.

BRITISH COLUMBIA

[illegible] FOR A RAILROAD TO THE BIG MISSOURI

Ashcroft.—The Provincial Department of Mines has decided to undertake some surface work on the Snowstorm group, which is controlled by Stewart Henderson, of Victoria, to facilitate further drilling operations. Ninety tons of ore shipped from this group prior to 1915 gave a smelter return of 36% of copper, and 40.5 tons, won in the sinking of a shaft in 1916, gave smelter returns of 23.7% of copper. Last January, under the Mineral Survey Act of 1918, the Department of Mines let a contract to the Diamond Drilling Co., of Spokane, for 10,000 ft. of drilling on the Snowstorm. Five thousand feet of this work has been finished and has shown such excellent results that the further work has been decided upon, in order that the remainder of the drilling might be carried out to better advantage.

Portland Canal.—Sir Donald Mann is paying another visit to the Big Missouri, where he will meet in consultation Mr. Bancroft, of McGill University, and F. H. Minard, of New York. A trail is being built to connect with the Stewart-Premier mine trail, so that ore may be taken out this winter, if possible. It is considered not improbable that a railroad will be built from the Big Missouri to Stewart next year. A good tonnage is assured, as the Premier mine alone is said to have developed well over 1,000,000 tons of shipping ore above the bottom level, and, as the orebody at that point is stronger and richer than at the surface, it is reasonable to suppose that there is considerable ore below. The Big Missouri contains an immense body of low-grade ore, as well as some shipping ore, and there are a number of other mines that would contribute. The country is difficult, but Sir Donald is an old railroad campaigner, and, if the freight is assured, will not be easily dismayed by obstacles. Boyle brothers, of Anyox, who have the contract for the diamond-drilling at the Big Missouri, have been given a drilling contract on the Forty-Nine group. J. J. Conner and J. McNeill have bonded their claims on Bear river to G. Sievert, who is representing St. Louis capital, for $250,000.

Slocan.—The new 100-ton mill at the Noble Five mine is nearly completed. Two tunnels are being driven on the Reco group, which was acquired in the spring by James Dunsmuir, owner of the Noble Five, with the view to developing the No. 3 vein. A considerable quantity of ore has been developed on the Last Chance vein. A four-compartment raise has been driven to connect the lower workings and the main adit with the upper workings. The Rosebery-Surprise Mining Co. has struck a new body of silver-lead-zinc ore.

Grand Forks.—United States capitalists have taken a 30-day option on the Union mine, in the Franklyn camp.

the consideration is said to be $300,000. The mine has developed a considerable quantity of ore, running 0.3 to 0.6 oz. in gold and 30 to 50 oz. in silver per ton.

NELSON.—The tunnel at the Queen mine is now in nearly 1500 ft., and it is expected that the Queen vein will be cut in the next 100 ft. A. W. McCune, of Salt Lake City, bonded this property last year. The British Columbia Iron Co. has been incorporated to develop the iron-ore deposits at Bull river.

CARIBOO.—A syndicate of Barkerville people have secured a number of claims on Summit creek, and will start operations at once. J. A. Bryce, of Cobalt, Ontario, is developing some lode-gold claims on Prosperpine mountain.

VICTORIA.—The Pacific Coast Coal Mines, Ltd., has won its appeal in the claim for $84,000 damages brought against it by the Wellington Colliery, Ltd., and the Canadian Collieries (Dunsmuir) Ltd., in the court of appeals. Justice McPhillips was the only dissenting judge. The Pacific Coast company was charged with trespass for taking coal out of the corner of the Alexander property, belonging to the Wellington company, in the Cranberry district, South Wellington. The corner in question was between the Pacific Coast company's property and an abandoned slope of the Alexander mine. The Pacific Coast company claimed that W. L. Coulston, former manager of the Canadian Collieries and of the Wellington Colliery, had given his permission to take the coal out in consideration of favors and services he had received from the Pacific Coast company, and two witnesses testified to that effect. The plaintiffs relied on the fact that Coulston was dead, and therefore unable to refute the evidence of the witnesses, and for that reason, they claimed, the court should not accept the evidence. The court thought otherwise, and ruled accordingly.

MANITOBA

THE COPPER LAKE GOLD DISCOVERY.

COPPER LAKE.—R. C. Wallace, Commissioner of Northern Manitoba, has issued a report on the Copper Lake goldfield to which much attention has been directed by the discovery of a rich shoot of gold on a property now known as the 'Red Rose'. The shoot appears on the east wall of a vertical quartz vein 18 in. wide and occupies 3 in. of the wall. A pit has been dug 6 ft. deep. The highly sheared and somewhat decomposed greenstone on the east wall of the vein shows very coarse gold in panning across 2½ ft. at the bottom of the pit. The vein has been stripped for 200 ft. and ranges in width from 18 to 6 in. On the adjoining claim to the south, in what is probably the same zone, the folding of a vein 18 in. thick is clearly shown. The importance of the free-gold shoot on the Red Rose is increased by its proximity to a tremendous quartz body yielding low assays in gold. This quartz, which has been prospected over five claims, is well exposed for more than 2000 ft. on the two most northerly claims by cross-trenches varying in width from 15 to 30 ft. The other claims have not yet been sufficiently prospected to determine the extension of the lode, but on the fourth claim a large vein of quartz and country rock, less than half of which is quartz, is exposed for a width of 100 ft. The total length of the lode cannot be estimated until more work is done on the claims.

ONTARIO

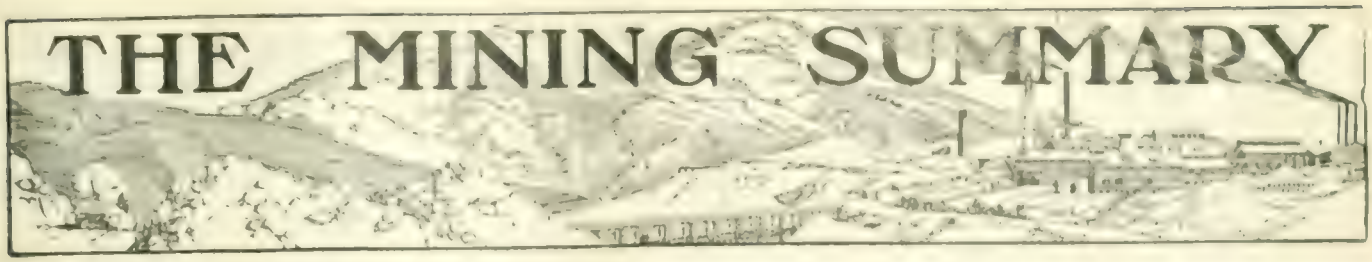
COBALT, PORCUPINE, BOSTON CREEK.

COBALT.—Conditions in this district are rapidly getting back to normal. Last week shipments of ore amounting to over half a million pounds were made by five mines, the Nipissing heading the list and also sending out 200,209 fine oz. of bullion. During July the Nipissing mined ore of an estimated value of $266,937 and shipped bullion from its own and custom ores of an estimated net value of $108,617. The McKinley-Darragh during the first seven months of the year realized net earnings almost sufficient to cover the full year's dividend payments of 3% per quarter. It is expected that the end of the year will show a surplus over dividend requirements. A significant feature is that during the first half of the year the cost of production was reduced to 60c. per ounce, as compared with an average cost of over 68c. per ounce in 1918. The share capital of the Kerr Lake has been reduced from $3,000,000 to $2,400,00, by reducing the par value of the shares from $5 to $4. The old Hylands property situated north of the Ophir will be re-opened. At the Adanac a new vein 3 in. wide carrying leaf silver has been intersected by a cross-cut at the top of a raise from the 310-ft. level. The Nipissing Extension Mines, a recently organized company of which A. J. Young of the Northern Concentrators Co. is president, has taken over the Farah property, on which high-grade ore was discovered in June last. Major E. H. Birkett, recently returned from service overseas, who was formerly a mining engineer at Boise, Idaho, has been appointed manager.

PORCUPINE.—Though labor conditions around Porcupine have considerably improved, production by the leading mines is still limited by a shortage of men. The most important feature of the annual report of the McIntyre for the year ending June 30 is the statement that the ore developed on the 1125-ft. level, now open for 900 ft. has materially enhanced the value per ton of the ore-reserves, which is now $11, as compared with $9.80 a year ago. The ore-reserves amount to 433,057 tons valued at $4,777,324. Gross earnings were $1,671,646, operating expenses $825,998, and net profits before providing for depletion of mining properties or war taxes $683,350, as against $680,361 for the previous year.

BOSTON CREEK.—Work is being carried on actively by the Boston McCrea company, which has done a large amount of exploration with satisfactory results. Telluride of gold has been discovered in considerable quantity, some of the ore yielding high assays. An electrically-driven mining plant will be installed and sinking operations begun. At the Mondeau some rich ore showing visible gold has been encountered in driving on the 50-ft. level. The property is equipped with a small steam plant

THE MINING SUMMARY



CALIFORNIA

Amador County.—The Keystone mine at Amador City is concreting the upper portion of the main shaft. For some time past, the settling of the ground around the collar of the shaft has caused trouble. Concrete foundations have been placed under the hoist building, head-frame foundations strengthened, and general repairs made. C. R. Downs of Sutter Creek is superintendent.

Forest Hill.—Oro Fino Mining Co., operating the Orpheum mine near Ophir, has acquired control of the Excelsior-Baltimore gravel property in this district. Haines Gridley, superintendent, has arranged to use electric power in place of steam, and plans to cut operating costs by other changes in equipment. The property is said to contain extensive deposits of medium-grade gravel.

Jackson.—Extensive improvements are under way at the Muldoon mine, which is owned by the Argonaut Mining Co. Although it has been deemed advisable to seal the collar of the shaft and bulkhead the levels connecting the Muldoon with the Argonaut property until the mine fire is extinguished, the hope of making good use of this shaft in the future has evidently not been abandoned. A number of men are engaged in erecting a hoist building and laying concrete foundations for machinery just east of the shaft. The plant heretofore used at the Muldoon mine was out of repair and inadequate for the needs of the mine. With the completion of this improvement, the work of repairing the Muldoon shaft and such portions of the workings as will be found damaged will be greatly facilitated. This shaft forms, when open, a valued adjunct to the Argonaut's ventilation system and a safety exit and it is believed the fire will shortly be smothered out and permit the re-opening of this part of the mine. In the meantime, the work at the Argonaut continues vigorously. Driving north and south in ore of high grade goes along steadily on the 4600-ft. level and workings on levels above. The 60-stamp mill is in continuous operation. N. S. Kelsey is general manager.

The California Slimes Concentrating Co., of which W. E. Darrow is president and other Sutter Creek men heavy stockholders, has obtained a new lease for five years on the Argonaut tailing. Many improvements, including the installation of flotation, are contemplated. A patented process, perfected by Mr. Darrow, is said to make a high recovery. The plant is so situated as to handle all the material that leaves the new 60-stamp mill. The tailing in the pond below the site of the old mill is also being milled at the present time but this is entirely separate from the Darrow plant and another company is handling this branch of the work.

Placerville.—A 4-ft. vein sampling $50 in gold has been exposed in the Marshall group, three miles north of Placerville. The property was located by James W. Marshall, discoverer of gold in California, and was worked by him for several years.——Good ore is reported in the Manzanita, operated under bond and lease by C. M. Jackson and E. M. Fessler of Stockton.——Bror Soderhjelm of the Ohio deep gravel mine states the gravel mill is to be placed in immediate operation. Gravel panning $2 to $10 has been found on bedrock, the rich streak occurring in a wide deposit of fair-grade material.

Redding.—Atascadero Copper Co. has decided to erect a reduction plant at its Greenhorn mine, near Tower House. The type of plant and process will be determined by experiments being made in Oakland. Large reserves of ore are exposed and arrangements made for mining during the winter. Alfred Hanford is superintendent.——The Red gold mine, Old Diggings district, Whitehouse post-office, is shipping 150 to 200 tons of ore daily to the Mammoth smelter, although the plant is idle. The ore is siliceous and 15,000 tons is stored in the smelter yards. Sinking the shaft was recently resumed and a new level opened. Harvey Sallee is manager.

Sutter Creek.—Driving north and south on the 3700-ft. level of the Central Eureka is yielding ore of excellent grade, and in addition an entirely new orebody, rich in specimen ore, has been uncovered on the 3500-ft. level. This probably means the profitable extension of work into a portion of the mine heretofore supposed of no importance. Stopes are now being worked on both the 3500 and 3700-ft. levels and sufficient ore is being mined to warrant dropping additional stamps. During the time required to sink the shaft for the new level and cross-cut to the vein, from 20 to 25 stamps of the 40-stamp mill have been dropping. The grade of ore mined during September has been so good, however, that the largest clean-up since the mine's re-opening in 1908 is anticipated. During the war period the Central Eureka had a hard struggle but at present the prospects are much brighter. Albion S. Howe is in charge.

Taylorsville.—Sunnybrook Copper Co. plans the installation of a compressor and erection of buildings. The property lies near the Engels group and has been undergoing development several years. Clyde Wardlow of Taylorsville is manager.

COLORADO

Chaffee County.—The Mary Murphy mine above St. Elmo is running its mill on the tailing and ore mined by lessees from the old upper oxidized zone. The cross-cut tunnel on the 1500-ft. level has been connected by raise with the 800-ft. level. No stoping has yet been done between. It is stated that on the lowest level 6 to 14 ft. of milling-grade ore is exposed. The ore carries principally silver, with some gold, lead, and zinc. The mine has produced $9,000,000. It is owned by an English company, and during the War development could not be pushed as rapidly as desired, particularly on the lower levels. Coal is used for power, but as there is a stream above the mill a hydro-electric plant may supersede this some time in the future. George E. Collins is general manager.——The Colorado-Independence, about a mile above the Mary Murphy, is doing development work and occasionally shipping a car of ore. Mr. Felton is manager.——The Flora Belle, adjoining the latter, S. L. Tabor, manager, is also developing. The mill is three or four miles below the mine at St. Elmo, adjoining the railroad. B. A. Hughes, metallurgist, has been changing their flow-sheet and has placed the Hughes patent riffle system upon the Wilfley and Card tables. He has shown that a clean separation can be made by water concentration. Most of the silver and gold goes with the lead instead of the zinc. The mill will probably shut-down until spring, in order to develop sufficient ore to be able to run continuously.

NEVADA

Austin.—Allan Rives and Nick Ableman of Tonopah have taken over the Big Thing group at Telluride and started developments. The group is 400 ft. from the Cahill group, where high grade ore was recently uncovered.——Jack McLaughlin reports finding a large vein carrying seams of rich gold ore a mile south of the Cahill property.——Austin people are operating the Cahill and driving a tunnel to reach the vein at a depth of 125 ft. The vein is said to be 100 ft. wide near surface, with several streaks of rich ore showing. A camp has been established and a 1200-ft. wagon road constructed to the claims from the county road. The ore carries tellurium.

Como.—Twelve inches of a new vein intersected 115 ft. from the Miller shaft of the Como Consolidated assays $800 to $1000 in gold, according to reports from the property. The discovery was made on the Lucky Sunday claim where the Lucky Sunday lode forms a junction with a new vein coming in from the hanging-wall side. The lode has been opened for a width of seven feet with no indication of the hanging wall.

Goldfield.—The Goldfield Development Co. has completed cross-cutting from the 380-ft. level of the Combination shaft into Florence-Goldfield ground, and started driving. Raises will be extended to develop promising ground near the old Riley lease workings.——The cross-cut from the 440-ft. level of the Crackerjack is out 30 ft. and should reach the Crackerjack vein before the end of September.

Hayden.—Ore is being sacked for shipment at the La Toska mine in Wright's canyon, eight miles south of Oreana and the same distance from Loring. The mine has been under development for some years, with an adit 3000 ft. long and drifts and winzes on two main veins. The first at 600 ft. in is 15 ft. wide and averages $8 per ton in gold and silver. The second at 1000 ft. in is 4 ft. wide, with a portion 18 in. wide that averages 25 oz. in silver and $10 gold per ton. Ore from this is sorted to a $45 grade for shipment. Owing to extreme steepness of the mountain and dip of vein, there is 1380 ft. of backs where this second vein is being worked. Chas. F. Champion, of Chicago, is president of the Humboldt Consolidated Mining Co., owning the La Toska, and John B. Newman is manager.

Loring.—The Jose-Davis company has developed an ample supply of water at its mill-site, three miles from the Sheepherder mine at Loring. A pump has been installed, much of the grading done and some of the machinery has already been hauled from the station and is now on the ground. The water in the well is quite warm, while the surface ground is normal, though several miles away the ground is so hot that snow in winter melts as rapidly as it falls. The Jose-Davis company continues to open up ore in the Sheepherder to feed the mill.——The broken parts of the compressor of the Nevada Honey Bee have arrived and work has been resumed in sinking the Malley shaft and driving Benedetti tunnel. Wm. J. Loring is general manager of the Honey Bee and J. H. Bell is superintendent.——Thos. Owens is running an adit on the vein on the Bangor where he recently made a discovery showing much free gold. He was the original locator of the Coalition at Seven Troughs, which was a heavy producer of sensationally rich ore.

Tonopah.—Gibraltar Silver Mines Co., of New York, has acquired the Gibraltar group, six miles west of Round Mountain. It is said a working fund of $200,000 has been provided and a mill is planned. W. N. Waddell, a New York broker, is president, and R. K. Sherwood secretary. C. Fredericks has been placed in charge of operations and plans to drive two tunnels. The outcrop is 250 ft. high with ore assaying well in silver and gold exposed.——The Arrowhead group has passed under control of Arrowhead Mines Co. Judge R. L. Johns is president, and C. J. Blumenthal, secretary

PERSONAL

Note.—The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

Stuart L. Rawlings has returned to Cerro de Pasco.

F. C. Webb motored from Denver to San Francisco.

Walter W. Lytzen is at Huron, near Prescott, Arizona.

S. K. Dahl, of Herculaneum, Missouri, has gone to Venice, California.

A. C. Nicholson, engineer for the Cleveland-Cliffs, is in New York.

R. S. Baverstock has returned to Los Angeles from Prescott, Arizona.

D. C. Wysor, consulting geologist for the Nichols Copper Co., is at Spokane.

T. J. Jones passed through San Francisco on his return from Siberia to London.

Douglas Waterman returned to Havana on October 2, going by way of New Orleans.

J. H. Collier passed through San Francisco this week on his way from Arizona to Colorado.

J. W. Mercer sailed from Boulogne for New York on September 13, on his return from France.

George H. Sexton, of New York, and **George W. Heintz**, of Salt Lake City, are at the Palace hotel.

G. Howard Birch, general manager for the Dan Creek Mining Co., at Dan Creek, Alaska, is in New York.

E. W. Engleman has moved from the Ray Consolidated to the Utah Copper Co.'s Arthur plant, at Garfield, Utah.

Frank Cameron sails on October 8 for Rancagua, in Chile, after a short holiday, spent chiefly at Salt Lake City.

V. K. Ting, director of the Geological Survey of China, sailed for China from San Francisco on September 26.

George O. Argall, of Philip Argall & Sons, is returning to Leadville after a couple of months holiday in California.

F. W. Collins, representing Bradley, Bruff & Labarthe, is on his way to Cerro de Pasco, Peru, by way of New York.

Alan M. Bateman, Professor of Economic Geology in Yale University, has returned from a professional trip to Alaska.

Roy S. Handy, mill superintendent for the Bunker Hill & Sullivan company, at Kellogg, is on a short visit to Yampa, Idaho.

Adolph Gernet sailed on the 'Persia Maru' with **Alexander Malozemoff**, manager of the Lena Goldfields, on the return to Siberia.

James L. Bruce has resigned as manager for the Butte & Superior Mining Co., to become general manager for the Davis-Daly company.

H. C. Hoover is at Palo Alto. The engineers of San Francisco have arranged a dinner in his honor on October 7 at the Commercial Club.

H. R. Bostwick and **A. R. Weigall**, accompanied by Capt. **F. B. Lawson**, of London, sailed on the 'Nanking' for Yokohama on October 2, on their way to Korea.

W. S. McCann, lately Captain in the Canadian Field Artillery, and now on the Canadian Geological Survey, was in San Francisco on his return from Grass Valley to Ottawa.

Obituary

Herbert G. Thomson, a graduate of the University of California, and general superintendent for the Nevada Packard Mines Co., at Lower Rochester, Nevada, died on September 25 from injuries received in a fall into a shaft while sampling ore. He is survived by a widow, a young

child, a mother, Mrs. Annie Thomson, of Oakland, and an uncle, John Fennis. Mr. Thomson was a highly valued correspondent of the 'Mining and Scientific Press'.

Frank Cochrane, Minister of Lands, Forests, and Mines in the Ontario Legislature, died on September 22 at Ottawa. On the return of the Borden Government to power in 1911, he accepted the Railway portfolio in the Federal Cabinet; but owing to ill health he resigned some time ago. As a young man Mr. Cochrane was prominently identified with the development of Northern Ontario, where, in a pioneer country, he acquired at first hand much of the knowledge that was later so valuable to him in his political career.

HENRY C. CALLAHAN

One of the best known mining engineers of California, Henry Clay Callahan, has passed on. Born at Callahan, in Siskiyou county, in this State, on October 6, 1852, he came of sturdy pioneer stock, his father, an associate of David D. Colton and "the Wells-Fargo crowd", coming to California by the Panama route in 1849, and his mother arriving by the same route in 1850, just in time to be present at the historic ball at San Francisco, in celebration of the State's admission into the Union in the previous September. Young Callahan first became interested in mining in the early 'seventies, through the hardware business, at White Pine, Nevada. In 1873 he went to Virginia City, and, upon the advice of E. J. Baldwin, began to learn mining at the bottom of the ladder, in the Ophir mine; and it was here that he was learning the dips, spurs, and angles of the mining game when Sam Curtis drove the historic 1300-ft. level of the Gould & Curry through the Best & Belcher ground, and gave the bonanza firm the advance information that enabled them to gain control of the Con. Virginia while the owners of the latter were sinking its shaft. Through the experience he gained on the Comstock he was appointed superintendent of the South Star and Titus mines, situated on Emma hill, in Utah, whose long-drawn out litigation with the Flagstaff gave him his experience in the ruinous costs of such affairs and implanted in him a distrust of the effectiveness of our American mining laws and customs, which was only strengthened by his experiences in the Australian goldfields in later life. After operating at Bingham and Tuscarora, he settled at Bodie, California, in 1877, but soon thereafter, during the Leadville excitement, accepted the management of the Bull Domingo mine, in Custer county, Colorado. From here he went on the mining staff of George Hearst in New Mexico and Arizona during the years 1881 and 1883, and thereafter returned to California, taking charge of the Bonanza King silver mine, in San Bernardino county. Later, after examining and reporting upon various properties for the Exploration Company, of London, including the La Union mine, in Costa Rica, he joined Bratnober & Wartenweiler in 1893, and, with Henry Bratnober, left for Australia in 1894. Here, in what proved to be the land of opportunity for Loring, Fred Thomas, Hoover, and so many other Californians, he made reputation and fortune. After some exploration work in New South Wales, he came to Coolgardie, in Western Australia, for the first time. At that period, the afterward famous Golden Mile of Kalgoorlie, the adjacent district, was unknown except as an almost deserted placer camp known as Hannan's. Here were subsequently found the Great Boulder, the Ivanhoe, Lake View, Perseverance, and Associated mines. After two trips to London and two to New South Wales, he accepted the appointment of general manager of the Lake View mine. Callahan was a born geologist. He developed this marvelous mine, with its lode dangerously near its boundaries, and co-ordinated its every part. The remoteness of the country challenged but did not feeze his resourcefulness. With the genius of the engineer educated in the university of the mining camps he solved the vexatious problems of transportation, water supply, cyanidation, accurate sampling and assaying of reserves, and was soon able to notify London of the real value of the Kalgoorlie lodes, and to forecast their wonderful future. The zest of the fight of the geologist and the mining engineer was supplemented by the romance of the plot and counter-plot of the London market that in many ways paralleled the excitement of the boom days on the Comstock. Though liberal and even generous in making business deals, he did not hesitate to fight to a finish where he felt his rights were unduly invaded. During his management of the Lake View and Ivanhoe he undertook the cyanide litigation. The demand to pay a royalty for the use of the McArthur-Forrest cyanide process he considered excessive, and he doubted the claim of right to collect the same in Western Australia. The managers of the other mines in the district were of the same opinion and agreed to share the expense of the litigation if the Lake View Consols would undertake to fight the

case, but their London directors refused to live up to the agreement. Some of the Lake View directors were inclined to pay $80,000 for the right of the cyanide patentees in Australia. Callahan had collected the evidence and the attorneys decided not to compromise. The Courts decided in favor of his company, and the decision was confirmed in the House of Lords. The cost of the litigation was 13,000 pounds sterling. Mr. Callahan became the leader of Kalgoorlie in its civic and industrial life. He was the head of the splendid commission appointed by the British government to represent Western Australia at the Paris exposition of 1900, and the only American upon it, and some years thereafter retired from active work, returning to California. He never married. He was a fine type of the virile, clear-brained, resourceful, far-seeing man of capacity, a courageous and trustworthy administrator, a good brother, a loyal friend. His profession is familiar with the type—the strong upstanding son of the brave Pioneer.—J. F. D.

Book Reviews

A System of Physical Chemistry. Second edition. By William C. McC. Lewis. Edited by Sir William Ramsay. In three volumes. Longmans, Green & Co., London. For sale by 'Mining and Scientific Press'. Vol. I, 'Kinetic Theory'. Pp. 494 + xii. Price, $4.50. Vol. II, 'Thermodynamics'. Pp. 403 + vi. Price, $4.50. Vol. III, 'Quantum Theory'. Pp. 209 + viii. Price, $2.50. Each volume complete, with table of contents and indexes.

The author of these volumes, as will be remembered by those familiar with the first edition, is Brunner professor of physical chemistry in the University of Liverpool, and well qualified to deal with this difficult subject. This edition has followed the general plan and arrangement of the first, but includes so many changes, necessitated by the advances made in physical chemistry during the last few years, that there has been considerable expansion in size. Volume III on the 'Quantum Theory' was in the first edition merely a chapter, but the rôle now played by the quantum theory in physical and chemical research renders this more detailed treatment necessary for the advanced student. These volumes are intended for use as a general textbook by those who already have some knowledge of physics and chemistry, and have therefore treated their subjects comprehensively and with thoroughness. Statements ascribed to other investigators are, whenever possible, quoted verbatim in order to avoid possibility of error or misunderstanding. The arrangement has been planned, in accord with what has been found best in Dr. Lewis' wide teaching experience, so that the most difficult part of the subject is deferred until the student has grasped some of the simpler principles. The volumes are adequately illustrated, and are recommended as a clear and orderly presentation of this intricate but interesting study.

Office Management. By Lee Galloway. Pp. 670, ill., index. The Ronald Press Co., New York. For sale by 'Mining and Scientific Press'. Price, $6.

The domain of the 'office' was for some time considered a sanctuary from the efficiency expert, but such is no longer the case. The office-manager must meet the cold clear eye of Missourians just as the manager of any other department. The present volume is one of the most complete that has appeared on the general subject indicated by the title. It discusses every branch of the office, including the clerical, stenographic, filing, purchasing, sales, advertising, and accounting departments. Selection of an office-building, office equipment, methods of organization, training of workers, wage and bonus systems, as well as many other minor subjects are also discussed. While much of the discussion is better adapted to the needs of the office employing several hundred clerks than to the small establishment, the office-manager or the owner of a small business will find a great deal that will be of interest and value to him.

The Metals of the Rare Earths. By J. F. Spencer. Pp. 279 + x. Longmans, Green & Co., London. For sale by 'Mining and Scientific Press'. Price, $4.50.

'Rare earths' is the term applied to the oxides of a number of metals that are characterized by a remarkable similarity of the physical and chemical properties of their compounds. They occur in complex mixtures, which can be separated into their components only by laborious and difficult processes, and are generally divided into two groups, the cerium earths and the yttrium earths. In different combinations they are used for a variety of purposes, of which perhaps the most prominent are welsbach mantles, sparking alloys for automatic lighting, for staining glass, and as a catalyst in the manufacture of sulphuric acid. The cerium compounds also have certain medicinal uses. The book goes thoroughly into all these phases of the subject. It starts with a history of the discovery of the rare earths, and then takes up their occurrence and the methods of separating them from each other. The two groups are treated fully. Methods of determining atomic weights—a difficult problem on account of the similarity of their chemical properties—is treated in great detail. The book closes with a description of their uses, and an exceptionally complete bibliography and set of indexes. It is a painstaking and orderly presentation of the facts that are now known concerning the rare earths, and is practically necessary to any chemist or student desirous of informing himself on the subject. We wish we could say as much for the binding, which is very badly done and not at all worthy of the contents. This, however, is a detail.

Handbook of Mechanical and Electrical Cost Data. By Halbert P. Gillette and Richard T. Dana. Pp. 1716, ill., index. McGraw-Hill Book Co., New York, 1919. For sale by 'Mining and Scientific Press'. Price, $6.

As the preface states, this book is intended as a companion volume to Gillette's 'Handbook of Cost Data', and also Dana's 'Handbook of Construction Plant'. The arrangement is similar to the former book, but there is little overlapping. In these days of abnormal prices, and of discussion as to whether or not large reductions will be made in the near future, some engineers and estimators may feel that a book of cost data, since its costs manifestly cannot be brought up to the minute, is of slight value. That this viewpoint is erroneous, provided the cost analysis is accurate and complete, is shown by the authors in the first chapter.

Recent Publications

Sand-Lime Brick. By Jefferson Middleton. II:2, U. S. Geological Survey, 1919. Pp. 2.

War Gas Investigations. By Van. H. Manning. Bull. 178-A, U. S. Bureau of Mines, 1919. Pp. 39.

Cost Keeping for Small Metal Mines. By J. C. Pickering. Technical Paper 223, U. S. Bureau of Mines, 1919. Pp. 34.

Prices of Mineral Acids. By H. L. Lewenberg. W. I. B. Price Bull. 45, War Industries Board, 1919. Pp. 18.

Prices of Heavy Chemicals. By H. L. Lewenberg. W. I. B. Price Bull. 46, War Industries Board, 1919. Pp. 20.

Salt Resources of the United States. By W. C. Phalen. Bull. 669, U. S. Geological Survey, 1919. Pp. 284, ill., maps, index.

The Kantishna Region, Alaska. By Stephen R. Capps. Bull. 687, U. S. Geological Survey, 1919. Pp. 116, ill., plates, index.

The Anvik-Andreafski Region, Alaska. By George L. Harrington. Bull. 683, U. S. Geological Survey, 1918. Pp. 70, ill., plates, index.

Bibliography of Petroleum and Allied Substances in 1916. By E. H. Burroughs. Bull. 165, U. S. Bureau of Mines, 1919. Pp. 159, index.

Recovery of Zinc From Low-Grade and Complex Ores. By Dorsey A. Lyon and Oliver C. Ralston. Bull. 168, U. S. Bureau of Mines, 1919. Pp. 145, index.

Annual Report on the Mineral Production of Canada During the Calendar Year 1917. No. 504, Canada Department of Mines, Mines Branch, 1919. Pp. 258.

Petroleum in 1917. By John D. Northrop. II:31, U. S Geological Survey, 1919. Pp. 219. From Mineral Resources of the United States 1917—Part II.

THE METAL MARKET

METAL PRICES

San Francisco, September 30

Aluminum dust, cents per pound	60
Antimony, cents per pound	10.00
Copper electrolytic, cents per pound	21.00
Lead pig, cents per pound	6.50—7.50
Platinum, pure per ounce	$87.50
Platinum, 10% iridium per ounce	$140
Quicksilver, per flask of 75 lb.	$105
Spelter, cents per pound	9.00
Zinc dust, cents per pound	11.00—14.00

EASTERN METAL MARKET

(By wire from New York)

Sept. 30—Copper is dull and easy. Lead is [illegible] and weak. Zinc is heavy and lower.

SILVER

Below are given official or ticker quotations in cents per ounce of silver 999 fine. From April 23, 1918, the United States government paid $1 per ounce for all silver purchased by it, fixing a maximum of $1.01½ on August 15, 1918, and will continue to pay $1 until the quantity specified under the Act is purchased, probably extending over several years. On May 5, 1919, all restrictions on the metal were removed, resulting in fluctuations. During the restricted period, the British government fixed the maximum price five times, the last being on March 25, 1919, on account of the low rate of sterling exchange, but removed all restrictions on May 10. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the former rate of exchange.

Date	New York cents	London pence
Sept. 24	115.75	53.50
25	116.87	63.37
26	118.87	66.75
27	119.50	62.62
28	Sunday	
29	118.75	62.12
30	117.00	61.00

Average week ending

	Cents	Pence
Aug. 19	111.68	59.14
26	111.00	60.66
Sept. 2	111.45	58.93
9	111.09	60.96
16	111.77	61.14
23	114.10	62.04
30	117.50	63.14

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	75.14	88.72	101.12	July	78.92	99.02	106.36
Feb.	77.54	85.79	101.12	Aug.	80.10	100.31	111.35
Mch.	74.13	88.11	101.12	Sept.	100.23	101.12	113.02
Apr.	72.51	95.35	101.12	Oct.	87.38	101.12	
May	74.61	99.50	107.23	Nov.	85.97	101.12	
June	76.44	99.50	110.50	Dec.	85.97	101.12	

COPPER

Prices of electrolytic in New York, in cents per pound.

Date	
Sept. 24	21.75
25	21.62
26	21.62
27	21.50
28	Sunday
29	21.50
30	21.50

Average week ending

Aug. 19	22.33
26	22.83
Sept. 2	22.55
9	22.37
16	22.29
23	22.10
30	21.58

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	20.53	23.50	20.43	July	29.67	26.00	20.82
Feb.	34.57	23.50	17.34	Aug.	27.42	26.00	22.51
Mch.	36.00	23.50	15.05	Sept.	25.11	26.00	22.10
Apr.	33.16	23.50	15.23	Oct.	23.50	26.00	
May	31.69	23.50	15.91	Nov.	23.50	26.00	
June	32.57	23.50	17.53	Dec.	23.50	26.00	

LEAD

Lead is quoted in cents per pound, New York delivery.

Date	
Sept. 24	6.15
25	6.10
26	6.05
27	6.05
28	Sunday
29	6.05
30	6.05

Average week ending

Aug. 19	5.68
26	5.88
Sept. 2	5.90
9	5.83
16	5.97
23	6.20
30	6.07

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	7.64	6.85	5.60	July	10.93	8.03	5.53
Feb.	9.10	7.07	5.13	Aug.	10.75	8.05	5.78
Mch.	10.07	7.26	5.24	Sept.	9.07	8.05	6.02
Apr.	9.38	6.99	5.05	Oct.	6.97	8.05	
May	10.29	6.88	5.04	Nov.	6.38	8.05	
June	11.74	7.59	5.32	Dec.	6.49	6.90	

TIN

Prices in New York, in cents per pound:

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	44.10	85.13	71.50	July	62.60	93.00	70.11
Feb.	51.47	85.00	72.44	Aug.	62.53	91.33	62.20
Mch.	54.27	85.00	72.50	Sept.	61.54	80.40	
Apr.	55.63	88.53	72.50	Oct.	62.24	78.82	
May	63.21	100.01	72.50	Nov.	74.18	73.67	
June	61.93	91.90	71.83	Dec.	85.00	71.52	

ZINC

Zinc is quoted at [illegible] Western brands, New York delivery, in cents per pound:

Date	
Sept. 24	7.45
25	7.40
26	7.35
27	7.35
28	Sunday
29	7.35
30	7.40

Average week ending

Aug. 19	7.80
26	8.00
Sept. 2	7.80
9	7.70
16	7.60
23	7.50
30	7.38

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	9.75	7.78	7.44	July	8.48	8.00	7.78
Feb.	10.15	7.97	6.71	Aug.	8.48	8.08	7.81
Mch.	10.78	7.67	6.83	Sept.	8.31	8.08	
Apr.	10.70	7.04	6.49	Oct.	8.31	9.11	
May	9.41	7.93	6.43	Nov.	7.76	8.74	
June	9.64	7.92	6.91	Dec.	7.84	8.49	

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the east according to quantity. Prices, in dollars per flask of 75 pounds:

Date	
Sept. 2	95.00
10	100.00
16	100.00
23	105.00
30	105.00

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	81.00	128.06	103.75	July	100.00	100.00	100.00
Feb.	136.25	118.00	90.00	Aug.	115.00	100.00	104.00
Mch.	114.75	112.00	72.80	Sept.	112.00	100.00	105.00
Apr.	114.50	115.00	73.12	Oct.	107.00	130.00	
May	104.00	110.00	84.80	Nov.	102.50	130.00	
June	85.50	110.00	94.40	Dec.	117.42	115.00	

FOREIGN EXCHANGE

Foreign exchange has continued to improve during the week, several times showing such pronounced strength as to cause considerable comment. It would seem for the moment that the pressure on the exchanges has greatly eased off, while having the effect of some strength of speculative return—has turned strong. Manufacturing products which weighed on the markets a fortnight ago seem to have been well cleaned up or taken care of. Trading in mark options has received a tremendous stimulus from the recent advance. Demand emanates chiefly from [illegible] houses and is being supplied by the Foreign Trade Banking Corporation, whose staff is kept busy until late in the evening. The rises are said to account of European banks. It is understood Swiss banks in particular are marketing the options here as a hedge against losses outstanding in Germany.

A prominent exchange dealer says: "The German government has to all intents reduced the par of the mark to a quarter of its former value. A law has been enacted compelling payment of import duties in gold. But as gold is not available, the Government is permitting payment in paper marks which is a quarter of one-quarter of a gold mark. It has virtually reduced the par from 23.8c. to 5.95c. On this new par basis exchange shows a depreciation of only 35%. This reduced par will be advanced from time to time as Germany's financial position improves. But it is doubtful if anything will be done in that direction for a year or two, owing to currency inflation, aggravated by a huge loss of gold through payments for purchases of foodstuffs, and the enormous war indemnity."

Gold: According to the latest advices from London the Bank of England still exercises some measure of control over the disposition of South African gold mines, many of their output. Agreements have been made with the bank provides that they shall consign their production to the bank, but that they shall be free for five weeks after its arrival in London to dispose of it in the open market. No doubt the object of compelling shipment to London is to maintain the position of that centre as the world's premier distributing point. Without such control over their movements, consignments from South Africa would undoubtedly be routed directly to New York and other centres which are more attractive markets for the metal than London. If the gold is not disposed of within five weeks after its arrival in London, the Bank of England reserves the right to purchase it. It is not stated, however, whether the bank in that event will pay more than 77s.9d. an ounce, the price it allowed the miners before it entered with them into the present agreement. However, in the present position of sterling exchange, it is most unlikely that the central institution will succeed in retaining much of the new production.

If there were [illegible] restrictions on importation of gold into India, the market for the yellow metal would be [illegible]. Next only to China, India is regarded as a permanent [illegible] for gold, the trade being financed by [illegible] to remit the gold [illegible] the Indian [illegible] shipments of gold were [illegible] the private account of [illegible] is turned over to the Government mint, which allows a considerably lower price than is quoted in the open market.

Heretofore announcement has been made only on the Transvaal's miners entering into the arrangement with the Bank of England regarding the marketing of their output, but it is understood that Rhodesian, West African [illegible] have made a similar arrangement with the bank.

Quotations on September 30 are as follows:

Sterling:	Cable	4 19
	Demand	4 18
Francs	Cable	8 18
	Demand	8 20
Lire:	Demand	9 64
Marks		1 80

Eastern Metal Market

New York, September 24.

The quiet which prevailed in the metal markets has been accentuated by the steel strike.

Copper is dull and easy, outside quotations being lower, with the large consumers holding to their pegged price.

Tin prices show a declining tendency. The arrivals are fairly large and consumption is lessened by the shutting down of tin-plate mills.

With the demand light outsiders are making the market, but quotations are being held up.

The shutting down of galvanized plate mills in the Pittsburgh district is having an adverse effect on the zinc situation.

Antimony presents no features of interest.

IRON AND STEEL

The expected struggle between the steel companies and their organized employees started according to schedule September 22. For a day or two there was so much confusion and so many claims and counter claims that the situation could not be measured, and the magnitude of the opposing powers cannot be weighed yet. It is certain, however, that the mills in the immediate vicinity of Pittsburgh, especially the large ones operated by the United States Steel Corporation, have not been affected to any serious degree. In Chicago, Youngstown, Johnstown, Cleveland, and Buffalo it is different, for many great mills, as the press reports indicate, have been forced to shut-down, these including the Cambria works at Johnstown and the Inland Steel Co. of Chicago, both of which had worked out and applied carefully devised plans for employee representation in case of dissatisfaction. The main question at issue is recognition of the unions. Some big steel men, anxious to know just who is to control their businesses, are not entirely averse to having a test of strength at this time. They maintain the open shop is the right principle and they will fight for it. Of course the strike brought paralysis to every branch of the iron and steel industry so far as selling was concerned, most of the companies declining to take orders, and making no promises as to deliveries against the orders on their books. The lessened production of galvanized sheets, tin-plate, and many other products using non-ferrous metals will unquestionably seriously affect the metals if the strike is long drawn out. This remains to be seen. At the outset it appeared that the mills had the best of the situation. At this writing both sides are pointing to the alleged exaggerations of the other.

COPPER

Quiet as the market was, it has been made more so by the strike of steel-mill workers. The market, in regard to prices, has continued to pursue an irregular course, the large producers holding electrolytic nominal, at or near 23.50c., while dealers and smaller producers are willing to sell at 21.75c., and possibly lower. Only actual negotiations would determine just what figure would be accepted. It is maintained, however, and probably with truth, that should a large tonnage be wanted it could not be obtained at the low figure referred to. Meanwhile, in a dull and weak market, consumers are not much inclined to buy, the very readiness of sellers to urge sales tending to make the consumer more cautious. Government offerings of brass are also having a deterrent effect. For the last quarter electrolytic quotations range from 21.75 to 22c., with Lake at 22.25c. Only guesses can be made as to the ultimate effect of the steel strike, but one thing is certain: the non-ferrous metals to a large extent go with iron and steel.

TIN

As in copper, the tin market is most seriously affected by the steel strike. Spot Straits metal was quoted September 23 at 55c., September Straits shipment at 53.50 to 53.75c., and last quarter shipment at 53.25c. Very little has been done in the week and the prospect is for even greater quiet. Meanwhile arrivals from London and the Far East have been fairly large, 2160 tons arriving at Atlantic ports in the first 18 days of the month, and 825 tons at Pacific ports. The total quantity now afloat is 6300 tons, so it is evident that, under prevailing conditions, there is plenty, if not a surplus, to meet demand. Virtually all the leading tin-plate mills have been closed, for how long only time will tell. Spot Banca can be had at 54.50c., and 99% Lamb & Flagg at 54c. for spot. The London market yesterday quoted spot Straits £279 10s.

LEAD

The market is being made by outsiders who quote 6.20c., New York, against 6.25c., quoted by the leading producer. Most of the makers are understood to have but little metal to offer. Not much has been done by any of the sellers. Some producers who stopped operations a few weeks ago are preparing to resume production, but as yet they are not quoting. Meanwhile demand is light and no great increase can be looked for until labor difficulties are somewhat cleared up.

ZINC

The market is quiet and a little easier, the quotation for prompt Western shipment today being 7.45c., New York, and 7.10c., St. Louis. The demand for galvanized sheets has been poor, resulting in the shutting down of several galvanized plate mills in the Pittsburgh district, on top of which comes the steel strike which will further lessen the production of plates and the consumption of spelter. The Geological Survey has issued its statistical report for the first half of 1919, and the fact that production in that period did not fall off more than it did has occasioned surprise. In the first half of 1919, 255,502 tons was produced, in the second half of 1918, 260,664 tons, and in the first half of 1918, 257,263 tons.

ANTIMONY

In a quiet market, 8.50c. can be done for prompt antimony, and this price might be shaded for carload lots. Jobbing lots run ⅛c. to ¼c. higher than the carload price.

ALUMINUM

No. 1 virgin metal, 98 to 99% pure, is unchanged at 32 to 33c. for early delivery.

ORES

Tungsten: There is no business to report, the trade being at a standstill. It is considered probable that the question of a duty on tungsten will come before the financing committee of the Senate within a week or ten days. Quotations are nominal at $7.25 to $7.50 for Chinese ore, $12 for Bolivian and $15 for Western scheelite.

Molybdenum: No change can be reported. There is but little inquiry. Hopes that the American surplus might be placed in Europe have faded with the information that the Europeans are ready to sell here. The nominal quotation is 70 to 75c. per lb. of MoS_2 in regular concentrates.

Manganese-Iron Alloys: Domestic makers quote $110, delivered. The price situation is not one that invites consumers to buy, while the effect of the steel strike on consumption must be considered. Spiegeleisen is quiet at $35 furnace, for 18 to 22% material.

INDUSTRIAL PROGRESS

INFORMATION FURNISHED BY MANUFACTURERS

NEW TON-AND-A-QUARTER GARFORD MOTOR TRUCK

The Garford Motor Truck Co. of Lima, Ohio, announces the addition of a ton-and-a-quarter truck to its already extensive line. It is to be known officially as Model 25. This latest Garford development is described as having ample wheel base and body space and is said to be the "huskiest" model of its capacity produced to date. Provision has been made for the installation of electric lights and an electric starter. The engine, of 22 hp., S. A. E. rating, has four cylinders 3¼ by 5½ in. cast in one block, with heads and valve chambers integral. The valves are large and ample water jacketing is provided. With the valve location on the right side and the carburetor on the left, the gas passes through a water-jacketed section of the cylinder. The engine is of sturdy design, employing a heavy crank shaft of the three bearing type, and cast iron upper and lower crank cases. The fly wheel is enclosed in a housing integral with the crank case. The pistons of gray iron are provided with three concentric tested compression rings. The pistons and connecting rods are of unusual length and the piston sweep is practically confined to the cylinder bore. Only a very small portion protrudes below the cylinder base when at dead centre.

The timing train is limited to three gears. This accounts in part for the quietness of operation that is characteristic of this model. The magnetic drive gear-shaft is extended forward of the gear-panel to drive the centrifugal water pump. When electrical equipment is required the magneto is driven in tandem with the generator, thereby eliminating the necessity of chains for this unit. The timing gears, which operate in oil, are helical in form and of very broad face. The crank shaft and four long rod bearings are of the bronze-shell, babbitt-lined type. The upper rod bearings are hard bronze. The oiling is of the constant level splash system. A gear pump driven by the cam-shaft circulates oil through a steel tube system to the main shaft-bearings, the overflow oiling the piston and cylinder. Lower rod bearings are oiled by splashers dipping into troughs filled by a feed from the gear-pump. Ignition both on the standard and the electrically equipped models is by straight high-tension magneto. The magneto is controlled from the steering-column. The spark-plugs are over the inlet valves. Carburetion is obtained through a Stromberg one-inch float-feed carburetor. The throttle control is by foot acceleration as well as by hand throttle from the steering column. The clutch is of the multiple dry-disc, ball-bearing type enclosed in a housing attached to the fly-wheel case. The transmission is a three-speed selective type with all gears and shafts constructed of 3½% nickel steel, double heat-treated. The shafts are mounted on roller bearings throughout. The gear and shaft rods are on top of the transmission case. As in all other Garford models the case is supported at three points.

The design of the Model 25 is characterized by its heavy shafts and large bearings. It provides for direct attachment of a power tire-pump. The front drive shaft employs a pair of composition discs. The drive is tubular, requiring no lubrication and eliminating the possibilities of grinding and rattle. The rear drive is of Spicer make, all steel, grease tight and dust proof. The front axle, of Garford design is manufactured entirely in the Garford plant. It embodies a single piece drop-forging for the load-carrying member, and nickel-steel knuckles. Oversize knuckle pins and a spherical seated ball-thrust mark this axle as unusual for a one and one-quarter ton model. The Model 25, virtually a ton-and-a-quarter truck, embodies characteristics of strength obtainable in a truck of one and one-half ton capacity. It has a one and one-half ton rear axle and a one and one-half ton frame, with a transmission of the same type. The housing of the rear axle (a worm drive type) is of one piece, thereby eliminating the liability of leaky joints and stretched bolts. The axle shafts are 2⅛ in. diameter at the bearing and have a splined fit in the differential. Timken bearings are used both at the wheels and differential. The differential is of the bevel type. Combined with the worm-carrier it may be removed from the axle as a unit. The worm is of hardened steel, the matting gear of bronze.

There are two independent sets of brakes operating on the rear wheels. Brake control is conventional in that one set of brakes is operated by pedal, the other by hand lever. Both braking systems have equalizers. Brake-shoes, levers, drums, and operating parts are unusually heavy, corresponding in size to most two-ton equipment. The radiator is of the heavy truck pattern. Upper and lower water tanks of cast iron are bolted to the vertical, finned tube, copper core. The radiator is mounted on a cushion suspension. Steering is by screw and nut—an irreversible combination. The hand wheel is 20 in. diameter and has a notched rim. It is of the five-arm malleable spider type. The entire gear is extremely rugged for a one and one-quarter ton truck. Gasoline is fed by gravity to the carburetor. The welded steel tank, located under the seat, has a capacity of 20 gal. A combined strainer and shut-off, attached directly to the tank, is employed in feeding the gas. Front and rear springs are of the semi-elliptic pattern with leaves of chrome vanadium steel. The former are 42 by 2½ in. with eight leaves, the later 50 by 2½ in. with eight leaves. The spring shackles are of drop-forged, heat-treated steel. Lubrication of the shackle pins is by oil feed. The frame of 7/32 in. stock has a depth of 5 in. and a width of 2½ in. It is of pressed steel construction and has six pressed-steel, channel-section cross members. All connections as well as brackets are hot riveted. Front and rear wheels are of wood with the S. A. E. standard felloe bands.

The standard tire equipment is of the solid pressed on type. The front tires are 36 by 3½ in.; the rear 36 by 4 in. Pneumatic tires, which are particularly adapted to this new model, come as extra equipment. The curved steel dash and seat-box are included as standard equipment with the chassis. These units are of high quality wood with a covering of heavy gauge body steel. The control is standard with the steering wheel at the left and the brake and the clutch at the centre of the chassis. The spark is controlled from the steering column. The lamp equipment includes two side oil-lamps mounted flush in the dash—a special feature

and one rear signal oil-lamp. The seat is extra wide and carries three persons comfortably.

A special effort has been made to standardize the Model 25 throughout, with the result that odd wrenches and spanners are not required. A full set of tools is included in the price of the chassis which is quoted at $1890 f.o.b. Lima, Ohio. Pneumatic cord tires 36 by 6 in. all around, a power tire pump and extra rim, are furnished at $285 extra. Electric lighting and starting may be had for $125 extra.

COMMERCIAL PARAGRAPHS

The American Continuous Retort Co., Denver, has issued a booklet descriptive of its system of retorting. This is a method of oxidizing ore at a low heat.

A 4-page 8½ by 11 in. folder has been issued by the **Page-Hersey Iron, Tube & Lead Co.**, Toronto, Ontario. This folder illustrates principally pipe bends and flanged joints.

The Chicago Pneumatic Tool Co. announces the appointment of Fred Gehbauer as special navy yard representative, with headquarters at its Philadelphia office, 1740 Market street.

The Drake Lock-Nut Co., San Francisco, has begun to develop an export trade. Recently several orders have been booked to Australia, New Zealand, Java, Siam, China, and other Oriental countries, and South Africa. Exclusive agencies have been given to large concerns in South Africa, New Zealand, and Australia.

Pamphlet No. 9-C illustrating impact screens has been issued by the **Colorado Iron Works Co.**, of Denver. This is a 24-page booklet that illustrates and describes various sizes of impact screens under different operating conditions. In addition, detailed drawings are given, showing the timber-work for setting the screens, and drawings by which the parts may be identified.

The Wellman-Seaver-Morgan Co. have issued Bulletin No. 22, which is a folder giving charts that show the relations in any shaft between power, shaft-diameter, torsional stress, and speed. The charts are so arranged that when any three of these are known the fourth can be found immediately. Wellman-Seaver-Morgan announce that they will be glad to send copies without charge to anybody who will write to them.

S. F. Bowser & Co., Fort Wayne, Indiana, has recently issued three folders describing the Bowser oil-storage system and accessories. The smallest one is so arranged that any combination of tanks from one to a battery of four can be shown, and all three illustrate and describe various types of their oil-storage and handling apparatus. They are attractively illustrated and should be useful to anybody interested in oil.

Transportation in mining districts is a complicated problem; therefore a catalogue on gasoline locomotives such as that just issued by the **McFarlane-Eggers Machinery Co.**, 2757-2763 Blake St., Denver, is always interesting. The first cost of these locomotives is small, and the operating costs compare favorably with steam and electricity. This catalogue illustrates and describes the sizes of locomotives peculiarly adapted to mining use, that is, those having gauges of from 18 to 36 inches.

Suit has been commenced by John D. Hoff by his attorneys Clarke and Clarke for infringement of his patent for calcining magnesite ore. The defendants are the Magnesite Production Corp. and Moore, Morrison et al, the owners of the extensive Sampson magnesite properties in San Benito county, California. The patent consists of a new and improved method of calcining magnesite ore in vertical kilns. The by-path process ensures a continuous operation of the kiln, and a more perfect calcination of the ore for plastic purposes. Mr. Hoff and his associates have also commenced action for recovery of the property that they have under lease and on which they have expended within the past two years more than one hundred thousand dollars. Operations have been suspended for some months because of the tariff situation and the scarcity of market demands.

Collins & Webb, Inc., Los Angeles, have opened a San Francisco office at 229 Rialto Bdg. This has been placed in charge of George Fisher, who was for many years general superintendent for the Riverside Portland Cement Co. They have also opened a new store in Los Angeles at 447-449 East 3rd St. This store gives them ample room to take care of their increasing business. It has a floor space 35 ft. by 100 ft., with three stories and a basement. It is equipped with a 2-ton electric elevator and has a private spur-track in the rear.

'Centrifugal Pumps for Irrigation and General Utility' is the title of Bulletin No. 11 issued by the **Pelton Water Wheel Co.** This bulletin shows a section of a typical pump-house, and contains many suggestions for the proper installation of centrifugal pumps. A rating table on capacities, speeds, and horse-power is included, as well as a table giving data for use in flooding land. There is, in addition, an estimate data sheet for proposed users to fill out and send to the Pelton company in order to receive full information concerning their particular problems.

The National Tube Co. has issued Bulletin No. 7, which describes the manufacture and advantages of 'National' welding-scale free pipe. This booklet, attractively printed on good paper, gives, among other things, a detailed description of the process by which a wrought butt-weld pipe is made free of welding-scale. It is fully illustrated with cuts that show the process clearly. Curves are given comparing the friction-loss for both standard wrought pipe and welding-scale free pipe, as well as a brief tabulation of the physical properties of this 'National' product.

A new **Allis-Chalmers** bulletin, No. 1456, on the Fairmount type crusher has just been received. This crusher obtains its effect by means of a roll, with removable teeth, which crushes the rock against a fixed curved anvil. Preliminary breaking of large pieces is accomplished by the sledging action of the teeth as the rock rests on the roll by gravity. When the larger pieces have been thus broken they are caught by the teeth and carried between the roll and the anvil. Crushers are illustrated up to 60 by 84 in., which has a capacity between 500 and 1500 tons per hour.

Troy trailers are illustrated, with specifications, in a 5-page 9 by 11 in. folder issued by the **Troy Wagon Works Co.**, Troy, Ohio. The same company has also published a 57-page pamphlet on 'Profit Sharing and Bonus Systems' as applied to trucks, trailers, taxis, and bus-lines. The object of this booklet is to improve the operating conditions under which trailers are used, and thus improve the service that they give. The booklet consists of a series of articles by different authors describing bonus systems that have been used successfully on different types of transportation. It should be interesting and useful to everybody having transportation problems to solve.

The Stimpson Equipment Co., Salt Lake City, has recently placed on the market the Mitchell electric vibrating screen. This was invented by B. A. Mitchell, chief mechanical engineer to the Utah Copper Co. at Garfield, and embodies a principle entirely new in screening work. By means of an ingenious electric vibrating mechanism, the screen receives rotary impulses that force the meshes up into the material 3600 times per minute. The amount of the motion is so small that to the eye the screen in operation appears merely as a blur, but the effect of this rapid vibration is to stir the material so completely that practically every particle of the undersize passes through the screen. An attractive booklet has been issued by the Stimpson Equipment Co. describing and illustrating this screen.

CIRCULARS have been issued announcing the forthcoming annual convention of the American Mining Congress at the Planters hotel in St. Louis on November 17 and the four following days.

PAYMENT of interest on the loans made by our Government to the Allied countries has been postponed by the Treasury department. This may have been done in order to prevent a further slump in foreign exchange, a condition inimical to international trade, but it may signify the eventual renunciation of interest on these loans to our Allies and even the cancellation of some of them. The loans amount to about ten billion dollars and the interest to about $500,000,000 per annum. Evidently the liquidation of the cost of the Great War will not be settled for many years to come.

STOCKS of non-ferrous metals in the hands of the British government are declining, it is pleasant to note. On September 1 the stock of copper was 63 million pounds as against 99 millions on July 1. During the same period the stock of lead decreased from 271 to 188 million pounds, and of spelter from 88 to 69 million pounds. During August alone the decrease in copper was 25%, in lead 22%, and in spelter 13%. This does not include any supplies held by private consumers, but it is encouraging to producers in this country. Copper is being shipped from New York on consignment, a custom that prevailed before the War. The metal goes to the European agents of American producers and is held by them for quick delivery as the demand expands.

PERPETUATION of mining-company organizations, to which Mr. Graton refers in his discussion of Federal taxation, is ilustrated by the Esperanza, which, we are informed, has arranged to acquire the Union en Cuale property in Jalisco, on the west coast of Mexico, in order to take the place of its exhausted bonanza in the El Oro district. A first payment of $250,000 is to be made, by instalments, before March 1821, giving eighteen months for exploratory work by diamond-drilling and also development work on the lower levels. A favorable report on this new venture has been made by the Esperanza company's manager, Mr. Charles Hoyle. Large widths of a complex ore rich in zinc, lead, silver, and gold are exposed in bodies of considerable length. It is estimated that a capital expenditure of two to three million dollars will be required to prepare the property for an output of 2000 tons daily. From two of the mines a production of six million ounces of silver is recorded down to a depth of only 400 feet. The property is on Banderas bay, near the port of Las Penas, and embraces 2000 acres of fertile land. The Esperanza directorate includes Messrs. R. J. Frecheville and F. W. Baker, both men of wide experience in mining affairs, and in Mr. Hoyle they have a thoroughly competent adviser. We trust the new venture will prove as successful as the old.

FREIGHT-RATES on steel from Eastern plants to California are so high—and discriminatory—as to warrant the protest filed recently with the Railroad Administration. The present rates are $27.50 per ton from the Atlantic seaboard and $25 from Pittsburgh, although before the War the water-freight by the Panama Canal was only $15, and delivery was made in 30 days, which is better than is done usually by the railways. These, moreover, have a nasty knack of delaying a part of the shipment, usually the one without which the entire building operation cannot proceed. The Pacific Coast will never be independent industrially until it fabricates its own steel. More than gold or prunes, we need domestic steel, made from our own ores in our own foundries. The ore exists and the fuel, but these two essentials have not been co-ordinated, as yet.

IN this issue we publish the first of a series of four articles on the technical operations conducted by the company controlling the Suan Concession, in Korea. This enterprise, which is associated with the names of Messrs. H. Collbran and H. R. Bostwick, has achieved honorable distinction among American ventures abroad and illustrates the application both of good judgment and skilful management. The authors of the articles, Messrs. A. R. Weigall and J. F. Mitchell-Roberts, are well known in the profession as highly competent technicians, therefore their careful account of the methods and processes used on the Concession will be much appreciated. Mr. Weigall is the manager and Mr. Mitchell-Roberts the assistant-manager, now retiring, for the Suan Concession. We publish a good map of Korea, on which the places of the other concessions are indicated. Of these the chief is the American concession near Unsan, where the Oriental Consolidated, a famous mining property, is situated. This is associated with the name of H. C. Perkins, who went there first in 1899, as recorded in the interview published in our issue of May 19, 1917. Mr. Perkins established the policy of training and employing native labor instead of depending upon imported white

labor. The English concession is identified with the Gwendolin mine formerly operated by the Anglo-Korean syndicate. The Italians have a promising copper mine at Hu Chang; this is operated by a company organized by the late Hansaburo Hunter. The Japanese concession is at Chiksan, where gold-quartz veins were worked before dredging for gold and monazite was undertaken successfully. The German concession was a failure; it was a placer mine, which was visited by Prince Henry of Prussia not long before the War; on which occasion he went through the motions of testing a pan-full of gravel in which several large nuggets had been placed. The reader will note the main line of travel from Japan to Korea, by way of Shimonoseki to Fusan, across the strait of Tsushima, 120 miles wide. It was there that the Russian fleet was destroyed by the Japanese in 1905.

SUIT has been brought by the Minerals Separation company against the Nevada Consolidated Copper Company for infringement of patent. This is the first case against the disseminated copper group of mines. The Minerals Separation people ask for all gains and profits above those that would have resulted if the Nevada Consolidated had adhered to straight water concentration during the past four years. The recent decision of the U. S. District Court of Appeals in San Francisco (as recorded in our issue of September 20) in the matter of the Butte & Superior company's exception to the injunction and accounting order of Judge Bourquin in the U. S. District Court of Montana shows that the Court of Appeals considers Judge Bourquin's inclusion, in the accounting order, of the use of the Callow cell as an infringement of Minerals Separation's patent to be warranted by the Supreme Court's decision and mandate ordering the accounting. Despite this decree, which dealt only with the payment of costs, the possibility of using the Callow cell in such a way as not to infringe is still a doubtful point. The question arises in the Miami litigation, which is not yet ended, the supplementary hearings in that case having been resumed recently after an adjournment. No matter what the decision may be, it is highly probable that the Miami case will be taken to the Supreme Court for final review, on a record that is considerably better, for the defendant, than the records in the Hyde and Butte & Superior cases.

Strikes

Industrial quarrels are not without a certain bitter humor. For instance, on the first page of our 'Review of Mining' we print the verbal exchanges that took place between the striking miners and the Alaska Juneau company. It will be noted that Mr. Fogarty—again an Irishman—and his friends are absurdly ignorant of the things concerning which they have been advising their following of malcontents. To suggest that the Juneau company is deriving profit from the high price of zinc and iron in its ore is hardly less foolish than to assume so confidently that the mine must be "on a paying basis" because it is being operated. Both of the two big companies at Juneau have been working at a loss for at least two years, as everybody ought to know. In our 'Mining Summary' we give the text of a statement issued by Mr. R. C. Gemmell, as general manager for the Utah Copper Company. This contains the suggestion that the men elect a committee to represent them in consultations with the officials of the company. The purpose, apparently, is to set aside the labor agitator and invite the men to act through representatives of their own choosing, thereby ensuring a voice for the quiet and orderly element. Usually during strikes the noisy and anti-social element is to the front, the conservative men avoiding trouble by leaving the locality as soon as violence or disorder impends. Judge Gary's cross-examination by the Senate committee was interesting. The chairman of the U. S. Steel Corporation took a firm stand on his refusal "to meet outsiders who are trying to organize the steel industry," meaning the men employed in that industry. To recognize professional agitators would mean the end of the effort, made by him and his managers, to maintain the 'open shop'. He suggested that "concentrated labor," no less than "concentrated capital," should be "subjected to control of the Government and of the law." He believed that "if a certain vicious element is defeated in this country" we may have fewer strikes everywhere. There is justification for his refusal to meet professional agitators, but we see no reason why the men, any less than the companies, should not pay lawyers or other specially qualified persons to represent their side in a disagreement with the company or its officials, because the average worker is not competent to do so. The companies give a handle against them when they hire professional strike-breakers, men of the toughest type and at the best only soldiers of fortune, not genuine workingmen, but usually inciters of disorder. The subsequent similar cross-examination of William Z. Foster, secretary of the steel strikers' organization, showed that he had been a rabid anarchist not long ago and that he had selected trades-unionism as a means for giving effect to revolutionary ideas. He acknowledged that "foreigners made up the largest membership in the unions at present." It is evident that he and his kind are opposed to Mr. Gompers and to the conservative element in the American Federation of Labor. The communities of Berkeley and Oakland, tributary to San Francisco, are paralyzed by a street-car strike caused by a demand for higher wages from a traction company that is on the verge of bankruptcy. The usual features of such a strike are in evidence, but the most interesting is the issuance of an injunction by a Federal judge forbidding intimidation, coercion, or interference on the part of the strikers against those willing to work. This is done upon the theory of a war emergency, the claim being made by the company that it is a war utility and entitled to protection under the Act of Congress of April 30, 1918. The question may reasonably arise whether this does not stretch the intent of the law unduly and represent an interference on the part of the Federal court hardly warranted under the circumstances, particularly as the Governor has not appealed for Federal assistance. Previously the

strikers had refused an offer of the City Council of Oakland to arbitrate the differences, although the traction company was willing to do so. To these notes on current disturbances of life and industry hurtful not only to the parties involved but to the whole community, we add the following observation. Last year only 3% of the American people paid income taxes; that is, belonged to the conservative or capitalist class. On the other hand the labor-unions have a membership amounting to about 4% of the population. Thus capital and organized labor together constitute 7%, and between them is the 93% that we call the 'public' whenever labor clashes with capital and both make life difficult for the community. This 93% ought to have more to say. At the time of this writing it seems as if the irreconcilable elements in the ranks of labor were about to fail in the attempt to dictate to the country, and as if the better element, led by Mr. Gompers and other sagacious leaders, would regain control of organized labor.

The Institute Meeting

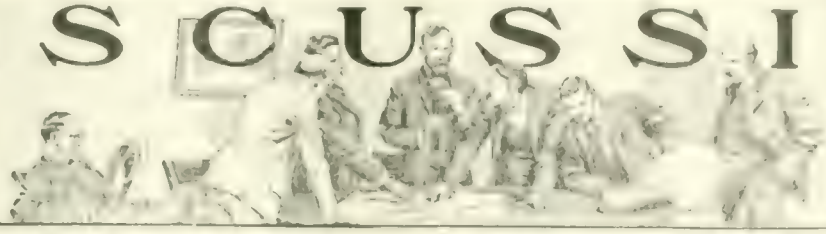
A full account of the recent meeting of the American Institute of Mining and Metallurgical Engineers will be found in this issue. The meeting appears to have been well attended, and its success was only marred slightly by the strike among the steel-workers, which rendered it necessary to omit the visit to the Gary plant of the U. S. Steel Corporation. Including the ladies, about 850 registered. The program of papers was unusually long and varied; indeed, we approve the criticism implied by our correspondent, a graduated mining engineer, when he suggests that a large number of the papers are outside the scope and beyond the interest of the average member of the profession. We venture to suggest that the value of such meetings lies not in papers, many of them poorly prepared and of wearisome length, but in the opportunity for making men known to each other and for the informal talks that ensue between practitioners from every part of the country. Better than the technical papers, which interest a few, are the discussions on general subjects, which appeal to the many, such, for example, as the question of Federal taxation, which was brought before the meeting by Mr. L. C. Graton in a paper that we take pleasure in publishing in abstract in this issue and in the one to follow. Even this paper, good as it is, would have benefited from the intelligent use of the blue pencil—it is needlessly long and by its length tends to weaken the force of the argument that it presents. Such subjects of timely interest when presented by means of a short summary of the points at issue, without obscuring them with an elaborate dissertation, are admirably suited to general discussion. They help to make men mentally acquainted with each other. Our correspondent gives an interesting description of the tungsten refinery at North Chicago, which was one of the places visited. The banquet was successful in eliciting several excellent speeches. Mr. Horace V. Winchell, the president of the Institute, used his opportunity to urge a larger interest in civic and national affairs. The return of Mr. Hoover from Europe gives point to such urging upon the profession to become politically minded, using these words in the broader and more correct sense of having an intelligent interest in all that concerns the life of a community and its relations to other communities. Mr. Hoover and the group of mining engineers that have worked with him constitute a splendid example of the useful—the supremely useful—participation of the mining engineer in national affairs. Mr. Schawb's speech must have been interesting because of the speaker's position in the steel industry, and his talk about human engineering must have pleased the efficiency experts, but we believe that a lot of the so-called human engineering fails for want of an 'e'—it would be better all round if it were not only human but humane. We would have liked to hear Mr. Theodore Robinson's speech, judging from such portions of it as our correspondent sends. He said a strikingly true thing when he asserted that "if there could be developed against the spendthrift and industrial shirker a popular sentiment akin to that which during the War obtained against the army slacker, the high cost of living and social unrest would soon disappear." We suggest that the shortening of hours and the increased wages paid to the manual laborer are not as portentous as the fact that he fails to carry out the implied contract, to do an honest shift's work. Not to do what one has been paid for doing is a form of taking money under false pretenses; it is dishonest, and by its dishonesty it corrupts the character of the man guilty of it. 'To deliver the goods' is an American phrase that embodies a sound bit of social ethics. It seems to us a pity that the speeches made at the banquet were not available as topics of discussion at the preceding sessions of the Institute; they would have elicited a better exchange of ideas and more opinions of general interest and usefulness than a paper on the heat treatment of duralumin or the pyrometry of a burning cigar.

Conditions in Siberia

By courtesy of a mining engineer intimately acquainted with conditions in Siberia, from which region he returned to San Francisco a few days ago, we are enabled to give the latest information concerning the impact of Bolshevism on mining in that part of the world. It will be recalled that early in June the Peace Conference at Paris, having received satisfactory replies from Admiral Kolchak as to the intentions of the government established by him at Omsk, declared that it was willing to assist him with munitions, supplies, and food, in order that his government might establish itself as "the Government of All-Russia." The agreement was signed by the premiers of England, France, Italy, and Japan, and by the President of the United States, but the fulfillment of this pledge was delayed, because a further inquiry was started before any assistance was sent, with the result that Kolchak's army suffered severe reverses and his government had to retire from Omsk. This, of course, affected mining operations adversely. Until July 25 the plant of the Kyshtim Corporation, a notable copper and

iron enterprise, was being operated by the Russian staff of the English corporation, but with the help and under the authority of the Siberian government, namely the party led by Admiral Kolchak. For months there had been no communication with the London office, the necessary financial arrangements being provided by the Siberian government, and these operations were fairly successful, that is, they were profitable in rubles. On July 25 the Bolshevik advance made it necessary to evacuate the works, whereupon, in order to prevent the operation of the plant by the Bolsheviki, all the essential parts of machinery were removed, together with the stocks of copper, gold, and silver. Altogether 80 carloads of material was removed. At the same time 350 of the *intelligentsia*, including families, were taken to Novo Nikolaievsk, where, without food or clothing, they await the oncoming of winter. The term *intelligentsia* as used in Russia signifies the intelligent members of the community in contrast with the illiterate mob to which Bolshevism makes its appeal. Meanwhile the copper mines of the Ural region, farther west, had been abandoned likewise, as soon as the Bolshevik armies advanced from Samara to Ekaterinburg. An attempt was made, during a brief interval between one Bolshevik occupation and another, to operate the copper-gold mines of Tanalyk, but unsuccessfully. When these mines were evacuated, the Russian manager was able to bring with him the quicksilver and bullion on hand. Nobody was killed. Ekaterinburg was the scene of a massacre. The refugees from this old mining centre in the Ural are now scattered over Siberia and from them our informant heard that the Bolsheviki had lists prepared beforehand, by their agents in the town, of those who were unfriendly to anarchy, and upon the arrival of the Bolshevik forces more than 2000 residents were taken from their houses and shot. Destitute and terrorized refugees from Ekaterinburg are now congregated at Barnaul, Ekibastus, and Simipalatinsk. The Spassky copper mine, a prominent and well established British enterprise, in the province of Akmolinsk, southeast of Kyshtim, was closed down, not by reason of Bolshevik irruption nor on account of any lack of labor, but owing to financial difficulties, the management being unable to come to an agreement with the Siberian government as to the price to be paid for the copper. No exportation, of course, was practicable; and the Government offered only 350 rubles per pood, equivalent to about 9 cents per pound of metal. The mill, for concentrating the lower-grade ore, was burnt down, accidentally, in August. Coming to the Altai country, which is southeast of Omsk, we learn that the Ridder mine continues to be under the protection of the Siberian government. This is true likewise of Ekibastus, where the Irtysh Corporation has its coal mines, as well as its lead-zinc smelter. The coal mines are being operated vigorously, 60% of the output being taken by the Siberian government for railroad use. Coal is also being supplied to the new line now being built, for military purposes, from Semipalatinsk southward to Sergiopol, near the Mongolian frontier. The remainder of the Ekibastus coal is being bartered for supplies that the management expects to find valuable later—at least, more valuable than paper rubles. The Russian Mining Corporation at Zmeinogorsk has been able to continue its prospecting campaign without financial assistance from the home office, in London, the revenue from trading having sufficed to meet the payroll and other necessary expenses. The Atbasar copper mine, which is isolated, is not being worked and probably has escaped Bolshevik sabotage. The trans-Siberian railroad is being operated successfully from Vladivostok to Omsk by the commission of American engineers under Mr. John F. Stevens. Westward from Omsk to Ekaterinburg the railroad was in the hands of a British military mission under General Jack, a man of remarkable ability as an organizer. He managed to save 95% of the rolling-stock, amounting to 25,000 cars and 500 locomotives, from Perm and Ekaterinburg at a few days' notice, in July, when the Bolshevik advance was made. This advance was rapid not on account of the progress made by the revolutionary army itself but by reason of the Bolshevik propaganda, inciting riots and uprisings in the towns, in advance of military occupation. Such uprisings would begin by men on armored motor-cars careering up and down the streets, shooting and terrorizing the population so that they stayed indoors and surrendered control. As regards Admiral Kolchak, our informant says that he is well worthy of support. Any government working under such manifest disadvantages must have weak links in its chain, but the Omsk government is, he believes, sincere and well intentioned. Some of the methods employed, of course, are arbitrary, because conditions necessitate prompt action. The whole country has to be under the strictest military control and there is no time for quibbling over questions of jurisprudence. Reports of intrigue and graft are common, and there is some truth in them; on the other hand, instances are more frequent of summary justice being meted to those who have attempted to bribe government officials. The government of Kolchak is radical, of course, in its views concerning the relations of capital to labor and intends that the living conditions of the work-people shall be bettered. There was a reactionary clique at Omsk, but it did not dominate. Kolchak himself is a patriot and a man of well-balanced mind; in him lies the hope of keeping Siberia out of the slough of anarchy into which European Russia has fallen. Questioned as to the future of Siberia, our engineer states that he believes the tide of Bolshevism will be stayed and that in due course the Government will render life and property secure. He expects the Bolshevik army to be driven back, relying upon General Denikine, who is advancing upon Moscow from the south, in co-operation with the Siberian army. This army is partly volunteer and partly conscripted from the young Siberians that have reached military age since the revolution in 1917. The Czecho-Slovak contingents are withdrawing toward Vladivostok, with the idea of returning home, so that only small detachments of them remain to guard the railway. No British or American troops are now at the front, but some remain to guard the railway, with a Japanese contingent.

DISCUSSION



A Message From South America

The Editor:

Sir—As one who has lived in six different countries during the past 17 years, including eight and a half years in Mexico and Peru, I would like to make some comment on the remarks made by 'Mining Engineer' under the above heading in your issue of September 13, as I think it is time some one took up the cudgels on behalf of the Spanish American republics and people.

All that is said regarding hygiene, honesty, cleanliness, and educational facilities I agree with; in fact, there are one or two more arguments against Spanish America that 'Mining Engineer' failed to mention, though I take exception to the remarks on the food question, as it has been my experience that it is only in outlying camps or isolated sections that one cannot get proper food.

Having stated the case *en contra*, let us see if something cannot be said *en pro*. First of all, why do foreigners go to Spanish-American countries? While some are actuated by a spirit of adventure and a desire to probe the unknown, is it not true that the great majority travel south of the Rio Grande because they expect to make more money than they do on the north side of that mis-named stream? This fact in itself is some recommendation. Another reason why foreigners go—or more correctly, why they return—to Spanish America is that there is a certain charm about the free-and-easy life that one leads there, an undefinable attraction about the last-century atmosphere in which things move more placidly, and the nerve-tension is less than under our modern high-speed conditions. They will curse all these things most heartily at times, but it is most remarkable how they go back to the Spanish countries. After a person has become established and has learned the language, a new world opens to him, rich in history and letters well worthy of consideration. If he takes the trouble to study the people and get acquainted with them, he will find the better-class educated Latin a very agreeable and courteous fellow with some characteristics to be appreciated.

It is hardly fair to make a direct comparison between the U. S. and the South American republics, as the latter are in a comparatively crude and undeveloped condition. Just how many decades they are behind, I am not prepared to say, but any intelligent Latin-American will join with the foreigner in deploring the backward condition of his country and in welcoming improvements; so that, any criticism of Spanish-American countries must be tempered with consideration of conditions and people as they are, and not as we think they ought to be. Lack of population brings in its train scarcity of public funds, and, among other things, the consequent inability to launch a comprehensive educational system necessary for the formation of an intelligent public opinion, which is the real motive force in a republic. The difficulty of educating natives of the lower classes is apparent to anyone acquainted with, say, the Peruvian *cholo*, and without a good public opinion it is impossible to advance very far or to develop a national spirit. I think I am right in saying that, up to the time of the outbreak of the great war, serious attempts were being made to improve educational facilities in the South American countries.

I hesitate to believe that there is anything to fear from the Latin-American professional or commercial man who comes to the U. S., as, in the majority of cases, he comes to get experience or education which will enhance the value of his services when he returns to his native land. Surely there is no fault to find with this. Mining students used to go to Freiberg or some other European school before the American colleges were so well established.

In a comparison between countries, it must be borne in mind that no particular country 'has it all'. Each country has something that the others lack, for which reason it is always regrettable to hear anyone say that some particular country (I care not which it may be) is the only one fit to live in. I therefore wish to repeat, in defence of the much-maligned Spanish republics, that there is something about them which appeals, especially to the person who approaches them with an open mind, that there is some good in them, and that one may get quite a lot out of life there if he goes about it in the right way.

Regarding the boys who went overseas, it was precisely that "high-speed education in national values," which 'Mining Engineer' mentions, that prevented their forming any proper conception of the countries they visited; in other words, they did not stay away from home long enough to acquire any real national values. They are not altogether to blame for the ideas they brought back; they probably could form no others under the conditions and in the comparatively short space of time at their disposal, though many of them failed to realize that they were sojourning in countries racked and torn by three years of desperate struggle, in which the usual course of life was upset and everything was subservient to the needs of war. I claim to know whereof I speak, as I was in London during the last 16 months of

the War and took occasion to talk with many men of the A. E. F. Hence my belief—which has been strengthened by my observations since returning to this continent—that the men who went overseas did not come back with that appreciation of other lands that they would have had if they had stayed away longer. We hear so much nowadays about the brotherhood of nations, especially among the Allies, but there will be little meaning in this till we look more sympathetically and appreciatively on other lands; and, so that I be not misunderstood, let me state here that the Americans are not the only people to whom this admonition applies. Straws show which way the wind blows, and the doughboy's remark about his home town was probably due to the fact that he found himself in a place where the language, manners, and customs were different from those to which he was accustomed, and were therefore no good. He missed the corner drug-store and could not find the restaurant opposite the depot on Main street. If travel broadens the mind, then let us have some expansion of viewpoint and a desire to understand the other fellow and his way of looking at things. Even within the boundaries of the U. S., provincialism seems to be on the increase. One notices it continually. I heard a man from a neighboring State say in all seriousness on landing in Oregon that he could not understand why anyone should leave the United States (?) to come to a country like that (I'll admit it was raining at the time); and the terrors of the wild country a hundred miles west of Broadway seem to have a very real meaning to the inhabitants of a famous Eastern city—more straws, but they show tendencies nevertheless.

Finally, with regard to the American national spirit, by all means let us have it in plenty, but I don't think it needs any forced culture. It already exists, strong and aggressive. When the call came there was no more provincialism, but a united country, and the war effort of the U. S. is something to be so justly proud of that it calls for an abler pen than mine to describe it. But let this national spirit be broad and liberal enough to enable us to realize that there are other countries whose history and traditions are equally as great as ours, so that we rise superior to the narrow viewpoint of 'we first, the rest nowhere'.

Perhaps I am too much a cosmopolitan, so if I have misunderstood 'Mining Engineer's' meaning, *le pido perdon de antemano*

OLIVER E. JAGER.

Nickelton, Ontario, September 19.

Mining on the Mother Lode

The Editor:

Sir—Referring to the editorial in your issue of September 13, commenting on the query of the mining engineer from Denver, who asked if the Mother Lode country was doing much mining, I should like to add my testimony regarding the increased mining activities of this region since the War ended. Development has increased by rapid strides, and no doubt this would have been a record year for the State of California if it had not been for the labor unrest such as that in the Grass Valley district. This, I am pleased to say, has returned to normal conditions once more, thus giving the State a chance to make a good record in the production of metals during the coming year. If the mining industries of this State received greater publicity regarding their development in the various districts, the mining engineers of this country would realize that California was still a great producer and would be for years to come. My belief is that this State contains untouched orebodies greater than those that have been mined, although this optimism will doubtless surprise many Californian mining engineers. I wish that you could publish more articles showing the active work that is being accomplished, and thus enlighten our friends.

HARRY S. CORDELL.

Grass Valley, September 13.

The Problem of Capital and Labor

The Editor:

Sir—During the last few months the point of view of Capital has been thoroughly aired in technical journals and societies. The statements by W. R. Ingalls have been especially notable to mining men because they are so assertive of the lack of necessity for reform and so oblivious to the arguments advanced by Labor.

Briefly, the case of Capital is: (1) That it is the owner of plants, equipment, appliances, and other facilities which are necessary for the economic production and distribution of the commodities required for the well-being of the world. (2) That the greater part of the cost of raw materials, and ultimately of manufactured goods, is paid out as wages to the labor employed in producing them. (3) That mines, factories, or other units of Capital are for the most part operated in competition with other similar concerns and that by this means the profit is reduced to a minimum. From this point, the argument is obvious. The raising of wages, or reduction of hours of labor, raises the price of commodities, and Labor, being the principal consumer, has to pay more in proportion; nevertheless, the conditions of competition between the various units of Capital are not altered, and in the long run Capital must take the same percentage of profit.

The case of Labor has always been that there is an unnecessary and unnatural disproportion between the standard of living maintained by most rich people and that maintained by working people. This, it will be remembered, was the stimulus which led Henry George to study economics and ultimately to suggest the single tax system in his well known book 'Progress and Poverty', afterward translated into so many languages. It is quite logical that, with only this phase in view, ignorant peoples, such as the Russians, should take the situation by force and try to reduce all people to a single grade of living. The more intelligent laborers of other countries, under the tutelage of such stable-minded men as Samuel

Gompers, have seen that there is some reason in the case presented by Capital. They have realized that the controller of capitalistic enterprises can multiply his time and energy by having personal attendants and by being surrounded with other comforts and facilities, the like of which cannot be afforded by the laborer.

The viewpoint of Henry George was that in manufacturing businesses there was so much competition that such industry could not be a cause of the oppression of Labor. He considered, however, that there was not sufficient competition between the owners of rich agricultural lands because such lands were limited, but that all capitalistic concerns were connected to and controlled by agriculture because they drew in the long run a similar percentage of profit, rent, or dividend.

With the progress of the United States it has been proved, however, that most agricultural lands are only profitable when held by small owners who work themselves, and that the extraordinary development of manufacturing businesses, with the preservation of competitive conditions within the country, has not modified the disproportion in the standards of living. We are therefore brought to face the same problem that Henry George failed to solve, but with the advantage of facts which he did not possess.

In general, economic adjustments are made by the natural law of supply and demand, the only condition for the fair operation of such a law being the existence of enough competition. There are, however, phases which from their very nature are not subject to such a law. There is certainly sufficient competition between manufacturing concerns, and for this reason it is generally assumed that the profits of such concerns are wholly determined by that competition. The fact is, however, that the way profits are expended has also an important, though indirect, effect in fixing the amount of profit.

Profits are necessary for two purposes: (1) To supply capitalists with a living; (2) to build the extra plants, equipments, appliances, and other facilities that are required for an increase of population and of efficiency in labor and technical methods.

Unfortunately there is no competition in the conservation of capital. Any individual may consume his capital or all his profits by maintaining a standard of living which is entirely unwarranted by the amount of the capital. It would, therefore, seem that the just objection of Labor should not be to the possession of productive industries by Capital, but to the dissipation of capital, using the term dissipation in its broadest sense.

A wealthy Englishman writes me that he considers wealth just as well conserved if spent in high living as if invested in industries. He no doubt has in mind the general idea about prosperity being promoted by keeping money in circulation. This effect is, at best, a subsidiary one and only follows under certain conditions. In reply to him I gave a clean-cut example, which, I think, may be profitably repeated here. Suppose a certain individual falls heir to a large factory. He lives highly and has finally to liquidate his estate, so that after a number of years he has nothing left. The factory was an enterprise giving employment to labor. It continued to exist in other hands and therefore it might appear that no wealth had been lost to the world. The material, service, etc., used in high living was actually consumed, destroyed, and forgotten. But had the labor and material been employed in building another factory, the world would have that much more wealth. The individual in question would only own one factory, however, and it might be said that he had exchanged the old one for the new. By expending his capital in high living it may, therefore, be said that he destroyed his factory without leaving anyone any benefit of it.

From a general knowledge of the world, such as anyone may pick up, I cannot help considering that as much capital is dissipated every year as is invested in new industries in the same time. This is the same as saying that half the profits of industry are dissipated. Those in control of capital should hardly be opposed to some regulation to correct the want of competition in these matters. If such men as Carnegie, Morgan, and Rockefeller lived a comparatively simple life and reinvested most of their profits, it is hard to imagine why they should not wish their heirs to do likewise. The great advantage to Capital, however, would be in the elimination of friction between Capital and Labor, for it would become obvious that any readjustment of wages, which would crimp Capital, would in the long run injure the interests of Labor. This effect is not certain under present-day conditions, a fact that labor fully realizes.

BLAMEY STEVENS

El Paso, September 9

War Minerals Relief Scandal

The Editor:

Sir—Naturally a great many readers of America's two leading mining papers followed the controversy between the editor of one and the editor-elect of the other. The vast majority, of course, knew no more of the facts than was revealed by the writings of the two principals, but that did not prevent their taking an interest in the matter or forming an opinion on the apparent merits of the case. As one of those readers may I comment briefly on the matter?

Everyone whom I have heard remark upon the matter agrees that the attacking editor once more proved himself a skilled dialectician—as was his teacher Huxley. In following the stand of "the Chief Engineer for investigative work under the Act," I could not help thinking that his was the typical point of view of the high-placed Government official. The American official, of course, is a man of extraordinary merit, but he cannot act as he might personally, when he is part of a system. The system that administers a Governmental bureau has little time or encouragement to enquire closely into the case of an individual who may be getting treatment short of justice. Decisions have to be made promptly with no after-thought, and in case of doubt a subordinate is merely "relieved of further responsibilities". That the Chief afterward explains that "no onus was involved"

may cheer up the injured party, although it does not sound especially cheerful. It appears to me that such an incident has a bearing on the subject of Government ownership, particularly on the contention of the editor of the 'Edinburgh Review' that nationalization would create a machine too big for any man to handle and would kill the human element in industry.

There was some reference during the controversy to "the yellow press". In view of the number of times that 'yellow journalism' is referred to nowadays, would it not be well to define just what the term means?

P. B. McDonald.

New York University, September 13.

[The reference to yellow journalism was an expression of spleen, and was not taken seriously by us. When men are the object of adverse criticism they are prone to throwing such epithets at their critic. Every self-respecting editor has to risk that.—Editor.]

Technical Writing

The Editor:

Sir—I was interested in reading the article 'Technical Writing: Slovenliness' in your issue of July 26.

I agree with you that "engineers should keep technical words for appropriate uses, otherwise they loose their significance". We all get careless, and then again some of us do not know any better. For example, the definition of the word 'tunnel', or rather its significance, as explained in the article referred to, I do not agree with. We all know that a 'tunnel' in its general sense is a bore going through a mountain from daylight to daylight. It may be used for a railroad, a wagon-road, an aqueduct, or any old thing; but according to my vocabulary, and understanding of mining parlance, a 'tunnel' is a bore that goes into a hill or mountain from daylight, horizontally, through country-rock, and not necessarily daylight at both ends. An 'adit' is the same thing, except that it is driven on, or follows, a vein. I would not call the Argo bore, at Idaho Springs, Colorado, an 'adit'; to be precise I would call it a cross-cut tunnel. And by the same token I would not call the adit-levels on the Sunnyside mine, 'tunnels'.

Of course, if we take Webster's definition for the two words, or the 'Glossary of Mining Terms', in Morrison's 'Mining Rights', I may (or may not) be wrong.

Speaking of mining terms, we meet up with some that are peculiar, some that are very pat, and a lot of misnomers. We often hear the remark, "It has the earmarks of a mine". I suppose if they were mule ears it would be a big mine.

The remark, we so often hear, "Ore is where you find it", always reminds me of the old Cousin Jack (Cornishman) tributer, when asked how his 'pitch' was looking, who said: "Thee knows 'ow they bloody h'ore ez, me son, sometimes ez 'ere and sometimes theer, and wot 'ee edden, theer be oi". In plain English, "You know how ore is, my son, sometimes it's here and sometimes there and where it isn't there am I". I claim that to be pretty pat.

Some time ago I read a report on an Amador county property. It wound up by saying, "The gold in this mine is worth $20.67 per oz." I had always been under the impression that all gold was worth $20.67 per oz. Accompanying this report was a plan and vertical section, of the property, all in one. Possibly the maker could understand it, but I couldn't.

Clarence K. Colvin.

Los Angeles, August 30.

Metallurgy at the Afterthought Mine

The Editor:

Sir—In your issue of September 20 there appears the fifth installment of Mr. Herbert Lang's metallurgical journey to Shasta county. In this article he mentions the Afterthought and boldly states that the net result of the work done at the Afterthought thus far "has been the accumulation of over 7000 tons of flotation concentrate as yet unsold, of which 5000 is reported to contain 35% zinc, 4% copper, 6 to 8 oz. silver, and 30 to 40c. in gold. Another lot, estimated at 2000 tons, contains 22% zinc, 5% copper, and 8 oz. silver."

As regards the 5000 tons mentioned above, Mr. Lang is entirely wrong. There is nothing of the kind here and never was. A good tonnage of zinc concentrate was shipped, averaging over 41% zinc, or well above the zinc content given by him. A substantial payment is made for both the copper and silver contained in the zinc concentrate, and therefore not a loss as suggested by Mr. Lang. There was, however, about 3000 tons of concentrate on hand, largely collective, or product on which no attempt was made to effect a separation into zinc and copper concentrates. This product is now being smelted with copper ore, practically free of zinc, direct from the mine; and notwithstanding a high zinc content in the calcine delivered to the reverberatory, a considerable tonnage is smelted, yielding a matte of satisfactory grade and a slag very low in copper and the precious metals. Of course, a large loss of zinc must follow from such a practice, as was expected at this time.

Mr. Lang's remarks concerning the Afterthought might convey the impression that all efforts to work out a treatment process for such ore as the Afterthought mine affords have failed. We certainly do not believe so, and in justice to certain competent men who have been associated with us in a real honest-to-God effort to unearth a process whereby such complex ore could be made to yield a profit, and thereby make valuable a property which hitherto was neglected because the ore could not be treated at a profit, we ask that you cause Mr. Lang's statements to be corrected.

The flotation process in mind was really proved a commercial success, and has been abandoned only because a more suitable method grew out of it. We invite honest and constructive criticism always, because there was neither precedent nor sign post to point the way. We were pioneering.

John Tait Milliken.

Ingot, California, September 29.

Reminiscences of Dr. Raymond

By T. A. RICKARD

Early in 1891, on my way from New Zealand to France, whither I had been called by my father to take charge of a group of mines near Allemont, in the department of the Isère, I called at the office of the American Institute of Mining Engineers, which then was domiciled at 13 Burling Slip, below Wall Street. My purpose in calling was to make the acquaintance of the Secretary, Dr. Raymond, with whom I had been in correspondence, while in Australia, by reason of my first contribution to the Transactions, a paper on the Mount Morgan mine presented at the Cleveland meeting in June of that year. On being ushered upstairs into a cheerful room overlooking the water, I found two gentlemen in conversation. One of them, wearing a black silk cap, arose to greet me most politely and, in the act of shaking hands, asked: "Which one are you: Colorado, California, London, or Australia?" I knew what he meant; he wished to know which of the Rickards I was; for at that time our family had four or five representatives in the Institute. I answered promptly: "Australia"; whereupon he said: "Then let me introduce you to Mr. Emmons. We have just been discussing the origin of the masses of kaolin in the Broken Hill lode. What is the source of the kaolin?" I replied: "It is the product of decomposition from the feldspar in the wall-rock, which is gneiss." Thus I made my first acquaintance with two men whose friendship I am proud to have won later, for I did not begin to know them intimately until five or six years subsequent to this first meeting.

From France I sent to Dr. Raymond, for the Transactions, my contributions on 'La Gardette: The History of a French Gold Mine' and 'The Bendigo Goldfield', the latter the first of three papers on the famous old mining district in Victoria, Australia. These were presented at the meetings in October 1891 and February 1892, respectively. Within three years—1892 to 1894—I contributed nine papers to the Transactions. This literary activity was due in no small measure to the encouragement given by the Secretary, in whom I found not only an editor of extraordinary ability but a friend rich in stimulating helpfulness.

My second call at his office was in January 1892, about nine months after the first visit. I had come from France to New York to serve as assistant to the late George Cowland, who was acting as consulting engineer to H. H. Warner, of 'Safe Cure' fame, a promoter of engaging personality and, as I found later, of fluid integrity. At our second meeting Dr. Raymond mentioned that Emmons had made the criticism that I was not sufficiently careful in orienting my geological drawings. The Doctor bubbled over with merry humor and pertinent information. I made the most of my privilege to discuss [illegible] and to gain from him suggestions helpful in my next writing.

In the summer of 1892, while at Prescott, Arizona, I received a letter from Dr. Raymond stating that a Mr. Dunn had written to him from Australia charging me with plagiarism of his ideas on the structural geology of Bendigo; in short, Mr. Dunn claimed that my explanation of the lode-structure had been taken from him, without acknowledgment. When I read the first part of Dr. Raymond's letter I was dismayed, as might well be supposed, for this was a bolt from the blue. On reading further I found compensation; for the Doctor proceeded to say that I must not worry, the charge was refuted by the internal evidence of the text, the character of which afforded strong disproof of any such accusation. He enclosed a copy of his reply to Mr. Dunn, defending me even before he had received my denial. It was a striking proof of his confidence in my scientific sincerity, and it is worthy of record as testimony to the generosity of his mind. I wrote at once to disabuse him of the idea that Mr. Dunn was a man of no consequence, explaining that E. J. Dunn was a veteran geologist and a high scientific authority. At the same time I wrote to Mr. Dunn myself and told him that if he would withdraw his imputation I would explain how he had been misled and I would meet his criticism in a friendly way. Among the 'Errata' at the end of Volume XX of the Transactions will be found a note, by the Secretary, dealing with this incident. I need not go into it further, except to add that four years later Mr. Dunn cabled to me from New Zealand offering me an appointment as engineer to an important mining enterprise, and, when declining it, I was able to express my hearty appreciation of his good-will.

At the Chicago Exposition meeting in 1893 I had my first opportunity of watching Dr. Raymond in action, of observing how he managed the sessions and guided the discussions. His speech at the closing session of the International Science Congress, a foregathering of scientific men attracted by the Exposition, was in his best vein. The preceding speeches had been rather dull and several of the representatives of foreign countries had made the mistake of speaking bad English instead of good French or German. Hence it was a relief to listen to an accomplished speaker like Dr. Raymond. He arrested the attention of the audience at the start by saying, not 'Gentlemen', but 'Brethren'; and then, explaining that he had been called upon to respond for both mining and

metallurgy, he likened himself to the camels conspicuous in the Exposition grounds, because he had to "hump himself two ways," and so gave a humorous touch that put everybody at ease. Reviewing the proceedings and summarizing the results of the international gathering, he placed his finger on the significant feature of the conference, telling his audience that while they had brought forward new ideas and uncovered new principles, they had done even better, for they had "discovered one another."

In 1895 I was established as consulting engineer at Denver. Business was dull, so I was delighted to receive a letter from Dr. Raymond asking me to be his assistant in an examination of the Drumlummon mine, owned by the Montana Mining Company, an English corporation. He offered me a fee larger than I would have asked as a principal, and I mention the fact to illustrate another phase of his generosity. It was agreed that he should pick me up at Denver. When he arrived I arranged a luncheon in his honor at the Denver Club. The party included Thomas B. Stearns, Henry T. Rogers, Dean Hart, Dr. W. A. Jayne, Richard Pearce, and my brother Forbes. I knew that Mr. Pearce, who is now 82 and living near Liverpool, had had a falling out with the Doctor. The incident was characteristic. When Mr. Pearce was president of the Institute in 1889, he was presiding at a meeting, at Denver, to which the Secretary was late in coming. The President waited for the Secretary; he delayed the opening of the proceedings for ten minutes or more, expecting the Doctor to arrive at any moment, until it seemed proper to wait no longer. So the session was started with the reading of a paper, and this was hardly begun when the Secretary walked into the room carrying his dossier of papers and looking black as a thunder-cloud because the President had dared to begin the meeting without him. Unfortunately the two distinguished gentlemen did not come to a friendly explanation on the spot, and a coolness ensued. Mr. Pearce had told me the story, with regret. It is more than likely that the Doctor had forgotten all about it, but Mr. Pearce, a gentle man, felt uneasy lest the feeling of annoyance might have survived after many years. When our luncheon was coming to a close I decided to propose the health of our honored guest, desiring to bring him to his feet and feeling confident that he would make a delightful speech. As I was about to rise, Mr. Pearce, who sat on my left, said, "Mr. Rickard, will you allow me?" I said, "With pleasure." He rose and proposed Dr. Raymond's health in a charming little speech, conveying a friendly greeting, to which the Doctor responded in a similar spirit. He made a speech worthy of a bigger occasion, reviewing his early experience in Colorado and his contact with men prominent in the development of the local mining industry. Cordial relations were restored between the Secretary and the ex-President, although none of the other guests understood the significance of their fraternization.

Next day the Doctor and I took train for Butte, going thence to Marysville. During the journey we played chess, for he usually carried a set of chess-men; at other times he studied chess problems or read fiction. He was fond of Anna Katherine Green and Gaboriau detective stories and other light literature, because they afforded him mental relaxation. He talked a good deal and always interestingly, having an extraordinary fund of diversified knowledge. Among other matters I touched upon the early days of Leadville and the Chrysolite deal. The older men in the profession will recall the fact that the Doctor was mixed up in a mining scandal arising out of an over-valuation of the Chrysolite mine, nearly forty years ago. When I first went to Colorado, in 1885, that affair was quoted as a blow to the profession because it had hurt the reputation of an engineer so distinguished as Dr. Raymond. The Chrysolite was a rich silver mine and was the cause of much stock speculation on the New York mining market. An engineer whose name I forbear to mention[1]—let us call him Blank—was the manager. He had been a junior when Raymond was a senior at Freiberg and the Doctor had been a good friend to him at the Mining Academy, and afterward when Blank started his career in the West. The Doctor was engaged to examine and report upon the Chrysolite. He went to Leadville. As he trusted Blank, he accepted his statements about the quantity of ore in reserve, and did not sample the mine thoroughly. One large block of ground appeared to be solid ore and its appearance was confirmed by the manager's statements; so the Doctor made a highly favorable report, which caused quotations to rise in New York. The fact was that the block of supposed ore contained a large core of limestone, as was known to the management through a cross-cut, the position of which had been hidden. When later the truth became known there was a slump in the shares and Dr. Raymond had to submit to severe criticism. Much to my surprise, when I touched upon the subject during our journey to Montana, he said nothing against Blank. Apparently he cherished none of the resentment that would have seemed natural under the circumstances. Some years afterward, in 1902, he was approached by a famous mining engineer, then engaged in the promotion of mining schemes, with a view to his writing reports, on the understanding that the sampling should be done by younger men. He asked me, at Philadelphia, what I thought about it, and I urged him not to consider the proposal for a moment. "Remember the Chrysolite," I ventured to remark. The truth is that in business matters he was too trusting and too generous to succeed, especially when dealing with persons unhampered by scruples of conscience or a sense of honor.

On arrival at Marysville we were the guests of R. T. Bayliss, the general manager for the Montana Mining Co. Ltd. Charles W. Goodale, consulting engineer to the company, was also there. The gracious hospitality of Mrs. Bayliss and the company of such men as Bayliss,

[1] I am prompted to this reticence because I feel sure that Dr. Raymond would have wished it.

Goodale, and the Doctor made the dinner at the end of the day's work a delightful social function. As the Doctor's assistant I did most of the physical examination of the mine, and when, at the end of a week, the inspection was completed, we collaborated on the report. Our duty was to make suggestions for the further exploration of the mine, which was showing signs of impoverishment, basing our advice on geologic evidence, particularly of a structural character. If I recall correctly, we made five recommendations, three of which the Doctor was kind enough to accept from me. When the report was finished, he insisted upon my signing it with him, so that it became our joint report. Again he proved his generosity, for it was a great honor to me to have my name coupled with his in a report that was to go before an important financial group in London. Our stay at Marysville was made memorable by his vivacious conversation. The evenings were spent delightfully. He proved himself adept in whist, as well as a remarkably good chess-player. Indeed, in chess he achieved distinction; for example, he was selected as one of five to play against Pillsbury in a contest at Brooklyn; he once drew a hard-fought game with Steinitz; and in 1908, when a passenger to Europe on the 'Oceanic', he led a group of players who accepted a challenge for a match by wireless telegraphy from a similar group of passengers on the 'Campania'. The team he captained won, thanks to his leadership.

In 1900 Richard P. Rothwell asked me to join him in the editorship of the 'Engineering & Mining Journal', but when I discussed the matter with Dr. Raymond he advised me against the step. When later, at the end of 1902, I went to New York to take up the editorship of the 'Journal', which had passed, on the decease of Rothwell, into the hands of James H. McGraw and then into those of the late W. J. Johnston, I received a cordial welcome from the Doctor. Just at this time unfortunately he had to take a holiday in Europe, to correct the bad effects of over-work, so I missed his guidance when I first took the helm of the 'Journal'. During the three or four months while he was absent I edited many of the papers that appeared in the Transactions and on his return I accepted payment in the agreeable form of a number of back volumes of the Transactions, so as to complete my set. He was still a 'Special Contributor' to the 'Journal' and enriched its columns with an occasional letter or signed article. In 1903 he became interested in a controversy over the New York State College of Forestry at Cornell, and took up the cudgels in behalf of his friend Bernhard E. Fernow, who was then director of the College and is now Dean of the similar college in the University of Toronto. The Governor of New York had vetoed further State aid to the College of Forestry and it was claimed by Professor Fernow's friends that he had been influenced by a group of bankers, who objected to the logging operations near Saranac lake because it interfered with their shooting. Dr. Raymond sent me a letter on the subject, for publication, with the statement that it would be followed by six more. It seemed to me to be unsuitable for publication in the 'Journal', and, upon consulting the late Frederick Hobart, of Brooklyn, who had been a faithful assistant to Rothwell as afterward to me and to W. R. Ingalls in turn, I learned that the controversy was of a locally political character, rendering it undesirable in our columns. It had nothing to do with mining, even indirectly. After consultation with Hobart, I wrote to the Doctor stating that I could not see my way to publishing his series of letters on the subject.[2] My declination was couched, of course, in terms most friendly and respectful, but he was so annoyed that it was a long time before he would write again for the 'Journal'. He did not like criticism or opposition—nor do any of us, for that matter—and I remember his asking me if I had seen a certain article of his in 'Cassier's Magazine'. I replied, "Yes, I enjoyed it very much." Whereupon he exclaimed, "You could have had it, if you had not turned down those forestry articles of mine." I told this story one day to a mutual friend, who was quick to ask how I would like to have an article of mine 'turned down'. Then I remembered how, in 1904, I went to Dr. Raymond, as Secretary of the Institute, to offer a paper discussing the recommendation of a committee of the four engineering societies on standardization of abbreviations, symbols, punctuation, etc., in technical papers. These recommendations had been printed and circulated with the current pamphlets of the Institute.[3] He demurred to publishing my criticisms, because he thought it inadvisable to start a discussion on the subject, the Institute—or he as secretary-editor—having no desire to impose its style on anybody. I accepted his decision cheerfully and later the rejected paper became the groundwork of my little book on technical writing, published in 1908.

During the three years of my editorship in New York I was on the council of the Institute for a time and also a member of the first board of directors when the Institute was incorporated in 1905. The council, including the president, vice-presidents, managers, treasurer, and secretary, numbered 18, but the average attendance at the meetings was only 5 or 6. Those not present would be informed by the Secretary of the decisions reached in council and would send their approval by postcard. Dr. Raymond 'ran the show'. If any of us disagreed with his plans, he overwhelmed us with reasons in support. We recognized the futility of opposition, and, it is fair to add, we appreciated his thorough grasp of the position. As my office was not far away, I was a steady attendant at the meetings, and I found them interesting, simply because Dr. Raymond never was anything else.

At one of the last meetings that I attended, in the spring of 1905, the question of placing advertisements in the Institute bulletin was broached. I objected to the proposal, whereupon the late George W. Maynard, half in fun, suggested that my interest in another publication—the 'Journal'—was at the bottom of the protest. The Doctor interjected a friendly correction, saying that

[2] In a recent letter to me Professor Fernow says that he is glad I did not publish the letters, "for it would have been of no use and would simply have made bad blood for him."

[3] They will be found in Vol. XXXV., pp. 342-346.

there was no doubt of my loyalty to the Institute and no reason for impugning the sincerity of my motives. Nothing was decided at that meeting. Before the next one was called I went on a short visit to London and being a member of the council of the Institution of Mining and Metallurgy I attended a meeting at which, it so happened, this very subject of advertising was brought forward. The council of the Institution decided that it would be 'bad form' to sell the pages of its bulletin to advertisers, so the proposal was tabled promptly.[1] On my return to New York we had a meeting of the Institute council at which the subject was again brought forward by the Secretary. I objected again, and was supported by the late A. A. Blow. (Again the prefix 'late'! It is saddening to realize how many of these old friends have crossed the range). I suggested that the step was too serious to be taken by the small proportion of the council there present and that a fuller attendance was desirable before committing the Institute to such a radical departure. Dr. Raymond concurred. Soon afterward I left New York. In December of the same year, there came to me, in San Francisco, a circular stating that by "unanimous agreement" of the council, it had been decided to insert advertisements in the bulletins. I wrote to the Doctor, protesting that the decision could not have been "unanimous," because I was opposed to it, and Blow also. He replied that soon after I had left New York he had called a special meeting of the council, there had been a large attendance, he had explained at length the reasons for accepting advertisements, and he had done this so convincingly that everybody present had acquiesced, and if I had been there I also would have acquiesced! I appreciated the humor of the position and accepted it without further demur. This expression of confidence in his ability to persuade me if I had been present was characteristic—and the chances are that he would have persuaded me, by the eloquence of his argument, against my better judgment. He had a way with him!

I recall a delightful day—a Sunday, in April 1902—spent at the Doctor's home at 123 Henry street, Brooklyn. Robert M. Raymond[2] (now Professor of Mining in Columbia University) and I crossed the East river in time to attend the service at Plymouth Church, in company with the Doctor, Mrs. Raymond, and Miss Susan Raymond. We heard the Rev. Newell Dwight Hillis deliver a powerful sermon. After the mid-day dinner we went to the Sunday-school, which was directed by Dr. Raymond. He had been superintendent of it for 25 years and had resigned several years before, but the death of his successor had caused him to resume the duties of the position. He also conducted a bible-class, which Robert Raymond and I joined. It was immensely interesting. The Doctor's subject was the life of St. Paul. He began where he had left off the Sunday before, as if the break had been a minute, instead of a week, and poured forth a wonderful story, characterized by humor, erudition, and religious sentiment. When five o'clock arrived, the ringing of a bell called a halt, the bible-classes stopped, and the Doctor left us promptly to ascend the rostrum and conduct the closing service. The last hymn sung that afternoon was one that he had composed. Then we returned to the house and later accompanied the Doctor to the house of his aunt, a distinguished old lady, Mrs. Howard, where it was the custom for the Raymond kin to foregather at a prayer-meeting every Sunday. Then followed the informal evening meal, or 'supper', after which, I remember, the Doctor read one of Kipling's jungle stories, 'Rikki-tikki-tavi', delightfully. More good talk followed and finally he sent us back to the Brooklyn Bridge terminus in his brougham. The incidents of the day illustrated his versatility and also how entertaining he could be at any time or place.

More than once when I asked the Doctor to give me ten minutes of his time he would explain how busy he was and then talk for half or three-quarters of an hour. This seemed inconsistent. One day, meeting his brother, Colonel Charles W. Raymond,* I asked him if he had been to see the Doctor. "No," he replied, laughing, "I don't care to be used as a sounding-board." "How is that," I asked. "Well," he replied, smiling, "when I go to see him he says he is awfully busy and then keeps me for half an hour talking about some old subject in which he happens to be interested, and which does *not* interest *me*." I laughed with him, and recognized how I also had been pleasantly hoaxed many times. When I would telephone to him asking for a few minutes for consultation, he would reply that he was terribly busy but could give me five minutes if I came right away. Upon my arrival at his office we would consume three minutes in settling the matter in hand and then I would find myself taking a minor part in a conversation that would last for half an hour before I would remind myself of my duties elsewhere. He was simply thinking out loud on the subject that happened to be in his mind and on which he had been writing when I had arrived. He had used me as "a sounding-board," as the Colonel said. That simply meant that he would be so full of his subject as to bubble over with it, if interrupted in his work by a

[1] The council of the Institution has changed its mind since then. In April 1919 it "decided to add an advertisement section to the Bulletin" in order to increase its revenue. This departure was "undertaken with reluctance" but was considered to be "justified by the altered conditions brought about by the War."

[2] Who is distantly related to the Doctor's family. At the time of the Revolution their ancestors were cousins; but Robert Raymond's ancestor remained loyal to King George and moved into Canada, while the Doctor's ancestor supported George Washington. So Professor Raymond was born a Canadian and became an American by self-determination

* Soon after the date of this incident, in 1904, he retired with the rank of Brigadier-General. As chairman of the Board of Engineers created by the Pennsylvania Railroad Company, he supervised the design and construction of the tunnels under the Hudson, the East River, and the borough of Manhattan, as well as the great Pennsylvania Terminal in New York.

call. This is an excellent scheme for preventing waste of time when a visitor arrives, in most instances the visitor fails to detect the expedient and goes away under the impression that *he* has had a good talk! As I write it, I can imagine the Doctor giving his little chuckle.

May I revert to my recollections of Dr. Raymond as editor of the Transactions of the Institute? What he did for me he did for others, therefore I venture to record my own experience in the matter. The effect of his teaching, as conveyed by the editing of manuscript and the explanations accompanying such revision, was far-reaching. The mining profession stood much in need of such teaching and the engineers that benefited from it will ever hold the Secretary in grateful remembrance. He not only revised our writings with painstaking care but he did something even more helpful: he would write long letters, in his easy flowing hand, six to ten pages, explaining why he had made certain corrections. He would give the benefit of his own wide knowledge and suggest additions or amendments of a character often vital to the value of the paper. My correspondence with him—voluminous and much valued—was destroyed in the San Francisco earthquake fire, so I am unable to quote details illustrating his method, but I do remember his reference to "the inveterate fluent profuseness" of my style, whereupon I gave him the *tu quoque* with a smile. The only time that we disagreed over his treatment of my manuscript was when he returned one of my contributions—the paper entitled 'The Cripple Creek Volcano'[6]—without correction. The galley-proofs and the original manuscript arrived together; I was quick to notice that the latter was entirely free from marks of revision. The editor had failed to edit. I wrote a respectful letter protesting that I expected the benefit of his criticism. He wrote back something complimentary about my not needing such assistance, whereupon I told him that my chief reason for sending my writings to the Institute was to obtain the help and protection of his editing, and that if I did not receive it I would divert my contributions to technical magazines, which would pay me for them. I returned the manuscript and the galleys, making my point, thanks to his friendly concurrence.

He was a most effective speaker, because he always had something to say and he knew how to say it. His memory was extraordinary. In 1904 when the Iron and Steel Institute of Great Britain held its annual meeting in New York, he was asked to be one of the speakers at a banquet at the Waldorf-Astoria hotel. The banquet was on a Wednesday; on the previous Monday he sent me, as editor of the 'Journal', the text of his speech, which he had written on the Saturday previous. I sent it to the composing-room and had the proof of it in my pocket when present at the banquet. If he had been unable to deliver it, everybody would have known that it was written out beforehand, because it went to the printer, as part of that week's issue (October 27, 1904) of the 'Journal', a day before it was to be delivered. While he was speaking I compared his phrasing with the proof in my hand. It was verbatim, even to interjections that seemed to be born of the impulse of the moment. For instance, he referred to King Edward, and, apparently on the spur of the moment, he interjected, "and may God bless him, as God blessed his sainted mother," a sentiment that elicited instant applause. Another similar interpolation referred to producers and consumers; he exclaimed, "Whom God hath joined together, let no man put asunder." The speech was most successful, of course; but he made a mistake, and it is one made by many less clever men. When the speech as written had been spoken, he made a fresh start, adding the equivalent of twenty or thirty lines. The chairman, Mr. Andrew Carnegie, rather discourteously, I thought, interrupted him, so that the effect of the speech was marred. Coming out of the dining-room the Doctor said to me, "How close was it to the text?" I replied, "Perfectly." He continued, "But I ought to have stopped." "Yes," said I. In preparing the memorial address, I had written that his extempore speeches could not be distinguished from those that he had "memorized." His daughter, Mrs. Bellinger, to whom I read my address before delivery, suggested that "memorized" should be replaced by "written", because when he wrote a speech he did not have to memorize it consciously: the act of writing it served to memorize it. This retentive memory was a great help to him in public speaking.

At our Institute meetings he was usually called upon to make the speech in which the visitors thanked the residents for their hospitality. This happened so often that once he demurred. It was at Aspen. Several of us in turn had been requested by the chairman of the committee on arrangements to express the thanks proper to the occasion; each in turn suggested that the Doctor ought to do it, because we knew he could do it best. When he rose to respond, he began with an apology for an apparent disinclination to perform the gracious task. He was asked to speak so often, he said, that he was reminded of the Civil War veteran who had told his little boy so much about his own performances in the War that the boy exclaimed: "Pop, couldn't you get anybody to help you put down that rebellion?" When he made a witty or humorous point, he would smile and give a little chuckle, joining in the merriment. Another story. The Doctor was called "vindictive" sometimes, by those whom he engaged successfully in controversy. He was a skilful dialectician, and unhappy was the man whom he countered in controversy. Somebody asked Clarence King if Raymond was not vindictive. King demurred, suggesting that he was only belligerent. To illustrate the distinction he told the following story.

"Not long ago I was going up the trail from Silverton to the Silver Lake mine and I met a long train of mules carrying sacks of concentrate. Each mule had his tail tied to the halter of the one behind him, so that he was prevented from bringing his heels into action—all except the last; as I came abreast of him on the narrow trail and prepared to pass, I thought I saw a wicked look in his eye, so I said to the packer or mule-skinner, 'Is that

[6] In Vol. XXX, page 367, of the Transactions.

mule vicious?' 'No,' he replied, 'he ain't exactly vicious but he's kind o' versatile with his hind hoofs.' The Doctor was versatile—with his pen—undoubtedly, but he was a kindly man, a generous man, and if he used his pen so that it touched more than paper it was in the joyousness of combat and the exuberance of mind—not to hurt, but to make good his argument.

He had the ability to digest a mass of information quickly and to present it in attractive form. He could master a new subject with wonderful facility. This enabled him to give public lectures on a great variety of topics. For instance, George W. Maynard told me how one day he asked Raymond to dine with him on the following Thursday. "Thursday?" he replied, "No, I can't do it; I have to lecture on 'Storms' at the Cooper Union next Thursday." Maynard said, laughing, "What do you know about storms?" "Nothing, but I'll know all about them by Thursday." He did; he went to Washington, discussed the subject with the experts of the Weather Bureau, and returned in time to deliver a lecture that proved to his audience that he knew all about storms that was worth knowing. He accumulated knowledge as a kitten laps milk. He could correlate facts so that they became living knowledge. He was an educator.

Mining in Arizona in 1919

The value of the gold, silver, copper, lead, and zinc mined in Arizona in 1918 was $202,134,880, the greater part of which was for copper. Arizona continued to be the largest producer of copper in the United States and will probably maintain its position in 1919, but with a greatly reduced output during the first six months, when curtailment of production followed the reduction in the prices of metal. The output of gold in Arizona in 1918 was 262,919 oz., valued at $5,435,027, which represents a considerable increase over that of the previous year. The United Eastern and other gold mines in Mohave county, which contribute the largest part of the State's output of gold, continued to produce heavily during the first half of 1919, the grade of ores permitting mining under the prevailing high costs. The gold derived from copper ores, however, will undoubtedly be much less in 1919 than in 1918, for two of the large mines and smelters near Jerome were closed for three months. The copper ores of the Ray Consolidated, Miami, and Inspiration contain little or no gold, but the ores of the Copper Queen, Calumet & Arizona, United Verde, and United Verde Extension contain much gold. Most of the silver produced in Arizona is derived from copper ores and lead ores. The total output of silver in 1918 was 6,686,152 oz., valued at $1 per ounce. Mines in Yavapai and Cochise county produced the greater part of it. In 1919 there will probably be a decrease in output corresponding to the reduction in the output of copper. With the increase in the price of silver, some of the old silver mines in Yavapai county will become producers, and the new mill that treats the silver ores of the Hackberry property, in Mohave county, will probably add to the output of silver in 1919.

The production of copper in Arizona was 764,885,874 lb. in 1918, against 712,166,891 lb. in 1917. The market for copper in the first part of 1919 was decidedly poor, and the price decreased from an average of 24.70c. per pound in 1918 to about 15c. in March 1919. Much copper in ingots was piled in nearly all the smelter yards awaiting shipment, and only the greatly reduced current production was sent to the Eastern refiners. Several of the smelting plants were closed, the Shannon in January and the Sasco, United Verde, and United Verde Extension in February, though the last two resumed operations in May and June. The mines were producing at the rate of about 60% of their output in 1918. The monthly production of the Inspiration and Miami companies was close to that of the previous year, but the Ray Consolidated was making about half its former output. There was a general scarcity of miners and mechanics, and even the return of the troops failed to meet the demand; but the curtailment has permitted mine development and repair and reconstruction of furnaces after a period of forced production. One of the interesting features of the work of the first six months of the year was the continuation of stripping by steam-shovel on Sacramento Hill, at Bisbee. The United Verde began work with steam-shovels to uncover a large body of low-grade ore and kept a force of men making extensive improvements and additions to the capacity of the new smelting plant at Clarkdale. At Ajo the New Cornelia Copper Co. plans to construct a 500-ton experimental flotation plant for its sulphide ore, and at Ray the new mill of the Ray Hercules company was treating about 800 tons of low-grade copper ore per day.

The output of lead in 1918 was 12,503,689 lb., a decrease from 25,465,445 lb. in 1917. As the price was only about 5c. per lb. in April 1919, and there was no great demand for the metal, there will probably be a further decrease in 1919. This statement also applies to the output of zinc, which fell from 20,894,860 lb. of recoverable metal in 1917 to 2,269,643 lb. in 1918. The Arizona Hillside property, in Yavapai county, continues its shipments of rich zinc sulphide ore. Good zinc ore was said to have been mined by the Schuylkill company through the Tennessee mine, formerly a large producer of both lead and zinc.

The dividends of Arizona mining companies were reduced considerably in 1919. The largest contributors were the Phelps Dodge, Inspiration, United Eastern, Ray Consolidated, Arizona Copper, Iron Cap, Miami, and United Verde.—V. C. Heikes, U. S. Geological Survey.

DURING THE WAR the Japanese zinc industry was very prosperous, and large profits were made on ore imported from Australia and the French Indies. The signing of the Armistice dealt the industry a heavy blow, as it costs $200 per ton to produce zinc in Japan. It is expected this will result in a request for subsidies

Technical Operations on the Suan Concession, Korea—I

By A. R. WEIGALL and J. F. MITCHELL-ROBERTS

HISTORY. The Suan Concession is situated at about Lat. 38°48′ N. and Long. 120°20′ E., in Whang Hai province, central Korea, and 55 miles east of the city of Pyeng Yang. The elevation of the main adit at the Suan mine is 1150 ft. and the Tul Mi Chung adit is 900 ft. above sea-level.

The Concession as originally granted was a rectangular area of 15½ miles by 10½ miles. It covered, therefore, about 160 square miles. This area was reduced to 59,000 acres in December 1916 by eliminating such portions as appeared to have no mineral value. It was formally granted on November 4, 1905, to Arthur L. Pearse, who assigned his rights to the Korean Syndicate of London. In the early part of that year, when the Concession was granted in principle, although the actual grant was not signed, a triangular combination was formed to operate the property. This consisted of the Korean Syndicate, a British combination, Collbran & Bostwick,* an American firm with headquarters at Seoul, Korea, and a Japanese group represented by Mitsui & Company of Tokyo, Japan. This was the celebrated Anglo-American-Japanese combination which was the subject of much Japanese and Far-Eastern newspaper comment at that time, enthusiastically foreshadowing a new era of international co-operation for the development of Korea.

The main terms of the Concession, as finally ratified, were that the concessionaire had exclusive mineral rights within the area. The duration of the Concession was for a period of 35 years, at the expiry of which period the concessionaire has the right to renew the Concession. The taxation under the Concession was fixed at an annual tsubo (0.8166 acre, say, 30½ cents per acre) for all land selected for mining purposes, and in addition a royalty was to be paid amounting to 1% of the annual output of the mines.

When the property was examined, in April 1905, by engineers representing the three groups, the Japanese representatives considered that the Concession presented no mining promise, so the Japanese group withdrew, leaving the property jointly owned by the English and American groups. The Concession was then jointly operated by the Korean Syndicate and the firm of Collbran & Bostwick, the actual work being undertaken and supervised by the engineers of the Syndicate. After nearly two years of rather disappointing results, the Korean Syndicate abandoned further work on the Concession, the active operation of which was taken over in 1907 by Messrs. Collbran and Bostwick, the Syndicate leasing its half-interest for a royalty based on a percentage of the net profit obtained.

After the developments undertaken by Messrs. Collbran and Bostwick had proved the existence of profitable orebodies, the Seoul Mining Company was incorporated on April 27, 1908, to take over all right, title, and interest possessed by Messrs. Collbran and Bostwick, the property being then transferred to the Seoul Mining Company, which has continuously and successfully operated it since that date.

By the end of 1908 the development of the original Suan mine, at Holkol village, had progressed to a stage where a milling-plant was warranted and in the spring of 1909 a 20-stamp mill was purchased together with accessory plant, the design of which was based on ore-tests carried out by Abbott A. Hanks of San Francisco. Ground was broken for this mill on April 2, 1909, and on November 20 the first stamp was dropped. During 1910 another 20 stamps and accessory plant were purchased, the capacity of the mill being doubled. This addition was completed by December 1, 1910.

Active prospecting was started at once on other parts of the Concession, resulting in the discovery of the Tul Mi Chung mine. In the winter of 1911-1912 further prospecting led to the discovery of large orebodies, so that by the spring of 1913 the building of a plant for Tul Mi Chung was taken in hand. Ore-tests were carried out both at the mine and in England, on the results of which the present mill was designed in 1914 and shipped to Korea at the end of that year. Work was commenced on this mill in April 1915 and it commenced operations at the beginning of October.

Other mines and prospects have been discovered and are in course of development, though none of them have yet been equipped with a milling-plant. The most important is probably the Tong Ahm mine, which has lately become a regular producer, the ore being trammed to the Tul Mi Chung plant for treatment.

The Seoul Mining Co. was originally capitalized at $400,000, now increased to $563,625. An initial dividend of 25% was paid on the operations for 1910, the year in which milling operations were commenced. Since that date dividends at the rate of 50% per annum have been maintained, the total amount paid to the end of 1918 being $1,995,925.

GEOLOGY. The ore deposits of the Suan Concession are of the contact-metamorphic type, occurring in limestone around the edges of a granitic batholith, elliptical in shape and roughly six miles by five miles in its main dimensions. The periphery of this contact, which has been named the Collbran Contact, is about 23 miles long. The intrusion of the granite has uplifted and shattered the surrounding sedimentary rocks, producing intense contact metamorphism. Around the edges of the Coll-

*Henry Collbran and Harry Rice Bostwick.

Suan Contact orebodies occur irregularly in the altered limestone. These orebodies conform to the recognized type and show all the irregularities generally associated with contact-metamorphic deposits. In places the development of the typical contact-minerals has been very marked, and the whole occurrence forms a remarkably characteristic example of contact-metamorphism of the greatest scientific and economic interest.

In conjunction with the active prospecting and development carried out by the Seoul Mining Co., the services of D. F. Higgins were engaged for the purpose of mapping the Contact and of making a geological examination of the ore deposits of the Concession. On the completion of this work in 1913, Mr. Higgins made a report covering the economic geology, accompanied by a plan of the Contact. Subsequently he published a brief summary of his work in the January 1918 issue of 'Economic Geology', in a paper entitled 'Geology and Ore Deposits of the Collbran Contact of the Suan Mining Concession, Korea'.

In 1915, J. Malcolm Maclaren was engaged to make a geological examination of the Concession and, after spending several months on the property, made a report of great scientific and practical value on the economic geology.

The ore deposits occur near the granite in the limestone surrounding the granite intrusion. The limestone has been altered to marble and other metamorphic aggregates. The ore occurs in the altered limestone and its occurrence is invariably associated with faults that have served as passages for the hot mineralizing solutions, which on cooling have deposited the ore in its present position.

"The sedimentary rocks of the Collbran Contact are not mineralized over the whole length (23 miles) of the Contact. Schist in contact with grano-diorite carries no ore, and even in the contact limestone there are long stretches devoid of ore deposits. It appears that ore deposition is *not* dependent on mere contact of grano-diorite and limestone, but requires also that the contact region be crossed by faults connected with the cooling grano-diorite mass, the faults serving as channels of egress for hot ore-bearing solutions, that deposited their metal content on reaching the surrounding cold limestone."[1]

The orebodies exhibit irregularity as regards their distance from the Contact. In the Suan mine they have invariably been found adjacent to the Contact and with their longer dimension roughly parallel to it. In the Tul Mi Chung mine, although some orebodies occur within a few feet of the limestone-granite contact and even at the actual Contact, the more important ones are found at a considerable distance from it; as much as 1500 ft. In this case, however, the ore is in proximity to a tongue of fine-grained granitic rock that has been extruded from the main granite mass as a later phase of the intrusion. The outcrop of the orebodies of the Tong Ahm mine is some 1500 ft. from the Contact, but these deposits, which occur at the junction of the limestone with the overlying schist, dip at a flat angle and are rapidly approaching the granite as they are followed down. The Peh Jai orebody is some 5000 ft. away, and the Soctarie deposit occurs at a similar distance from the Contact. In general, it may be said that ore has not been found at a distance of more than one mile from the nearest point of the outcrop of the granite, and it is quite possible that the unexposed edges of the batholith in depth may be closer than the horizontal distance on the surface.

The sequence of ore deposition was as follows:

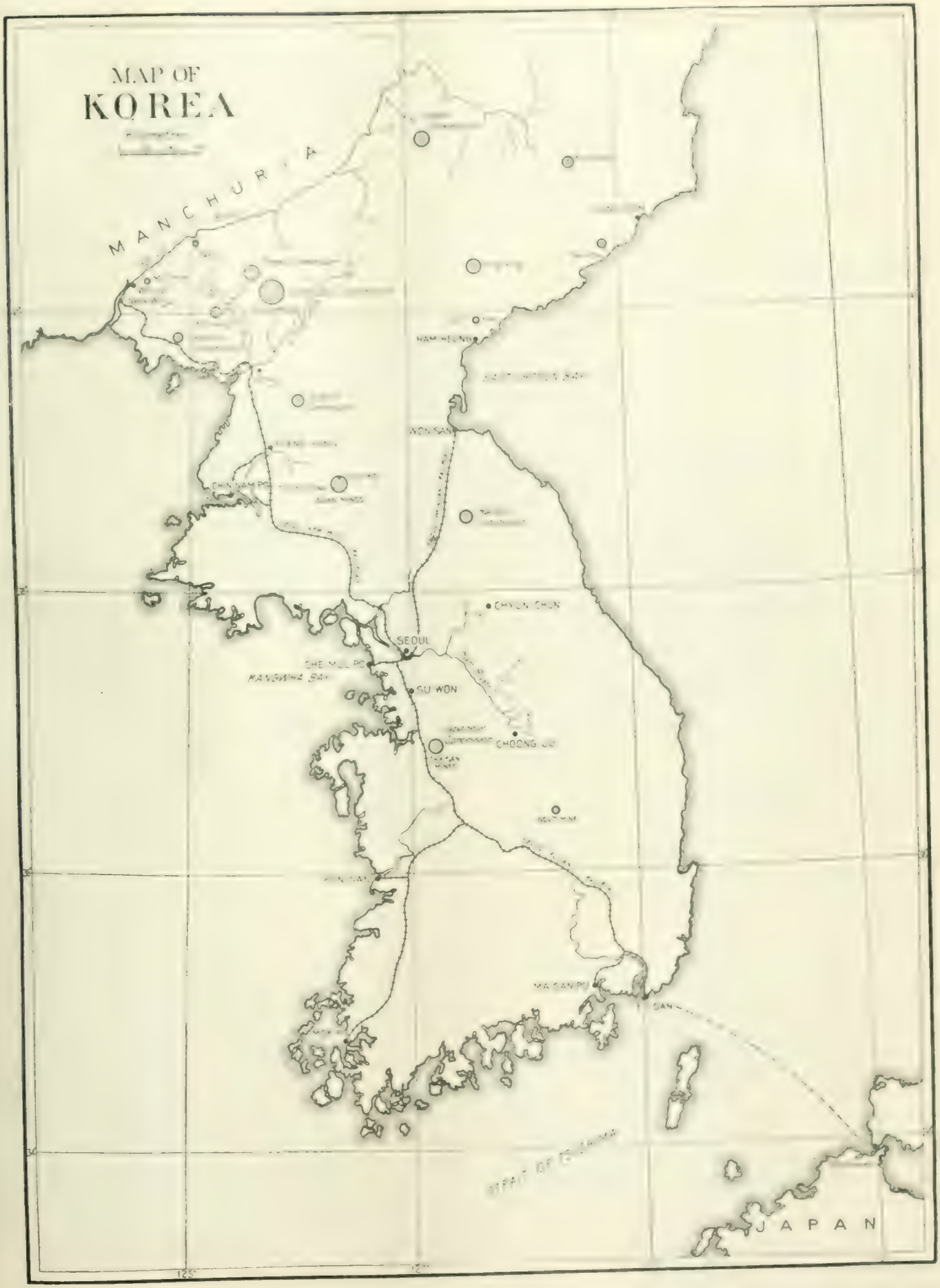
"It has already been pointed out that ore deposition has taken place as an end-action following the intrusion of the grano-diorite batholith, the sequence being: (*a*) intrusion of the main batholith through middle Paleozoic limestone and schist; (*b*) segregation within the main mass and subsequent extrusion of fine-grained granite, quartz-monzonite, quartz-diorite; (*c*) faulting of the region on a large scale; (*d*) emission of metalliferous solutions from the central grano-dioritic mass along fault-planes that connected the still heated interior of the batholith with the surface; (*e*) cooling of metalliferous solutions in the surrounding sedimentary rocks, with replacement of and deposition in limestone (1) of copper, gold, bismuth, molybdenite near the Contact and (2) zinc and lead farther away."[2]

The valuable metals in the ore are mainly gold and copper; bismuth, silver, and tungsten also occur as metals of economic importance. The amount of gold present is probably unusual in a deposit of this type. Galena and zinc-blende are present, also molybdenite, but so far no profitable deposit of these minerals has been discovered. As a general rule the gold-copper ores occur closer to the Contact and the lead-zinc deposits farther away, indicating that ore deposition was associated with the cooling of the solutions given off from the granitic magma. A great diversity both of ore and of gangue-minerals exists; for instance, on one part of the Concession a considerable amount of prospecting was done on an orebody that owed its value to the presence of a gold-bismuth telluride. Arsenic is present, both as mispickel and lollingite ($FeAs_2$). These arsenical minerals only occur in small quantity, averaging 0.25% arsenic in the ore of the Tul Mi Chung mine, but, as will be shown hereafter, they have a most important bearing on the metallurgical treatment of this ore, where a portion of the gold is closely associated with abnormally finely-divided lollingite, possibly as an arsenical-gold mineral. Scheelite occurs sparingly in most of the orebodies, also bismuth sulphide, and in places economically valuable deposits of tungsten and bismuth are being mined.

The gangue contains practically all the typical contact-metamorphic minerals. The presence of much garnet, almost invariably associated with the ore, and to a less extent magnetite, is important as affecting gravity concentration. Space will not permit of a more detailed description of the contact-gangue minerals, although these are of great geologic interest.

[1] Dr. Maclaren's report.

[2] Ibid.


MAP OF
KOREA
MANCHURIA
SEOUL
CHYUN CHUN
SU WON
CHOONG JU
JAPAN
125°

Secondary enrichment has not supervened, or, at most, to only an insignificant degree. The orebodies that are mined consist of the unaltered primary sulphides, and no falling off in grade with depth has been noticed. This point was clearly apparent when in 1913 a survey was made of the ore-reserve in the Suan mine. To supplement the mine sampling, some 2000 check-samples were taken by me at a time when the mine was opened up on practically every level, not only by drifts but also by stopes. Leaving out the surface impoverishment, extending to a depth of from 50 to 100 ft. from the surface, the average grade of the ore at the different levels was maintained down to the bottom of the mine, and on the lowest hundred feet above the point where the ore cut out the general grade was above the average grade of the whole mine.

As regards secondary enrichment and referring particularly to the Suan mine, Dr. Maclaren expressed the following view:

"As a result of my examination I have come to the conclusion that secondary (sulphide) enrichment has played no part whatever in the formation of these Holkol orebodies and that they represent primary sulphide deposits, the upper portions of which have been eroded away. The principal arguments for the above conclusions, none of which taken singly are conclusive, are:

"(1) The absence of any lean copper zone on No. 4 level. The eastern orebodies below No. 3 level cut out entirely and do not continue downward as poor ore, though the 'formation' or lode-channel continues. Further, there are small sporadic ore occurrences on and above No. 4 of only slightly lower grade than the ore of the main orebodies. There is apparently therefore no uniform impoverishment in depth. Accurate data on this head are, however, difficult to obtain owing to the impossibility of obtaining true samples of the ore.

"(2) Large bodies of pure iron pyrite exist in the upper levels that show no sign of replacement by chalcocite or chalcopyrite.

"(3) Absence of copper glance (chalcocite) in the eastern orebodies. A little copper glance was found in the western orebody.

"(4) The orebodies do not end downward along a definite horizon but as downward-stretching fingers or tongues. Their lower limit therefore does not indicate a 'pinch' or narrow place in the lode-channel.

"(5) No. 4 level shows a diminution in the quantity of iron pyrite in the lode-channel commensurate with the decrease of chalcopyrite, thus indicating a general cessation of metalliferous deposition in depth. With this there is also a general softening of the country downward, indicating less impregnation with silica; while at the date of this report only one patch of iron sulphide containing a little copper had been met with on No. 5 level."

With regard to the depth at which the ore deposits were formed, Mr. Higgins expresses the view that the depth "was probably about 20,000 ft., at a pressure of about 1500 atmospheres to the square inch; but this estimate may be subject to great revision." The only conclusive evidence regarding the depth below the surface to which the orebodies extend is afforded by the operation of the Suan mine, which has been bottomed at a depth of about 650 ft. below the outcrop, and is now practically stoped out. The ore did not cut off sharply in the bottom of the mine but died out in wedge-shaped points, below which only a few scattered patches of ore were found in the 'formation', which still persisted. There is no further evidence available as regards the depths to which ore extends, as the other mines on the Concession have not been bottomed. The deepest working on ore in the Tul Mi Chung is about 550 ft. below the outcrop.

In size the orebodies exhibit great irregularity both as to width and length. Generally they are roughly lenticular in form. The largest stope in the Tul Mi Chung is 400 ft. long with an average width of 30 ft., and every kind of variation in size and shape exists in the different stopes. In some cases pipe-like bodies, almost circular in plan, have been mined. The widest stope in the Suan mine was 96 ft. wide by 110 ft. long. The longest stope was about 300 ft. long by 50 ft. wide.

The following brief account of the ore deposits of the different mines and prospects on the Concession will illustrate the general types:

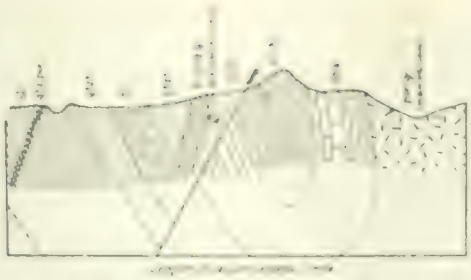
"The orebodies of the Suan mine are readily divisible into two groups, a western and an eastern. The former are formed along the fault-planes and apparently in their hanging walls, the latter along older fissures parallel to the granite contact, but are nevertheless limited west and east by two members of the eastward-dipping fault series."[3]

The eastern orebodies have produced the bulk of the ore that has come from the Suan mine. The smaller but richer western orebodies are roughly tabular or lenticular in form and occur on the great fault-zone that extends along the western side of the Holkol valley. "The orebodies of the eastern group are far more irregular, and occur in a series of interlocking fault-zones, which make up one large zone about parallel to the Contact and approximately at right angles to the west fault."[4]

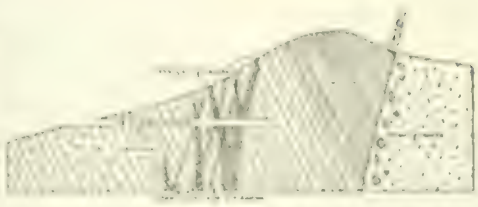
The eastern orebodies are separated from the granite by a layer of garnet-rock of varying width, but averaging 10 to 20 ft.; this lies immediately on the Contact. Between the garnet and the ore there is usually a band of a hard hornfels-rock, locally called 'schist', of about the same thickness as the garnet band. Next occurs the 'formation' in which the orebodies were formed. This varies in size from a narrow stringer up to a maximum thickness of 125 ft. The outer wall of the formation is composed of a dark limestone, which merges into the ordinary altered limestone of the contact-zone. Dr. Maclaren says: "While the garnet-rock and the 'schist' are developed from the limestone directly by the heat and steam of the adjacent Suan granite, hot waters and the material they contained altered and replaced the limestone along the fissure-walls and deposited nests of

[3]Maclaren's report.

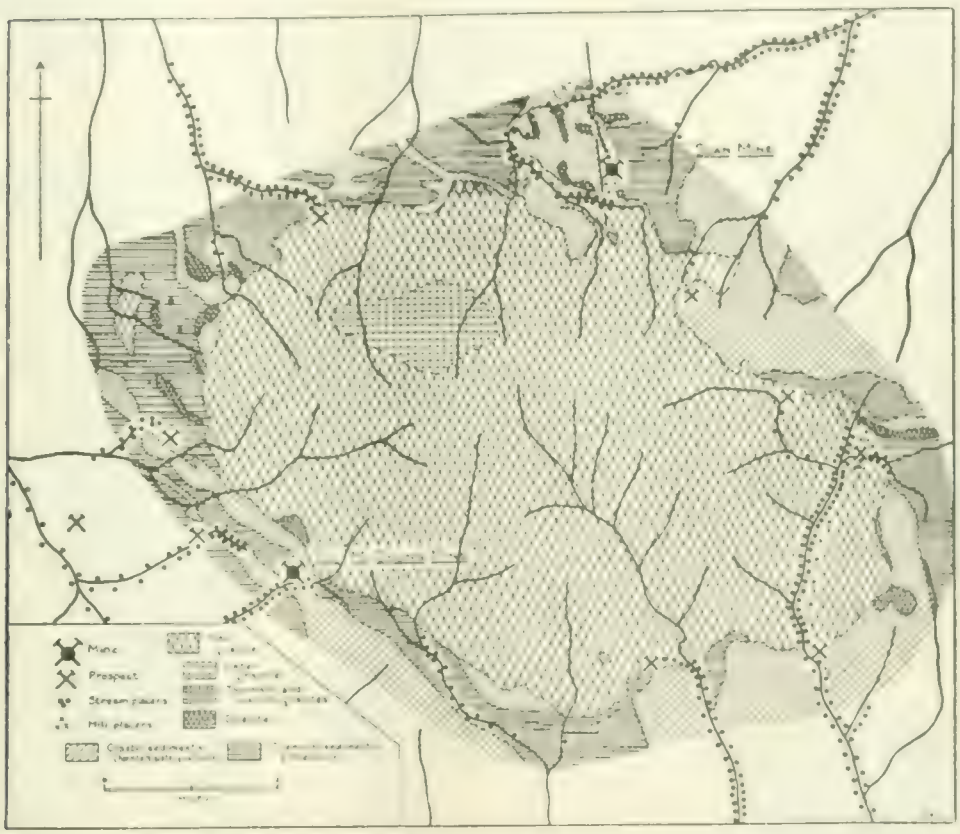
[4]Higgins in 'Economic Geology'



CONTACT NORTH OF YEE AH CHUNG

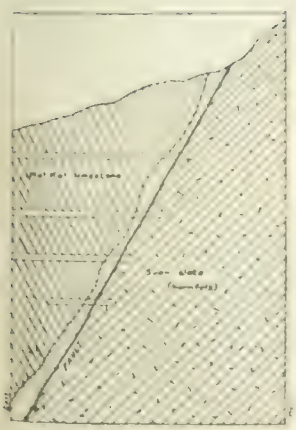


SECTION THROUGH PART OF THE MINE

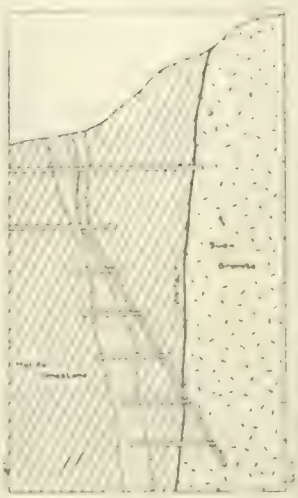


THE SUAN GRANITE AND THE COLLBRAN CONTACT

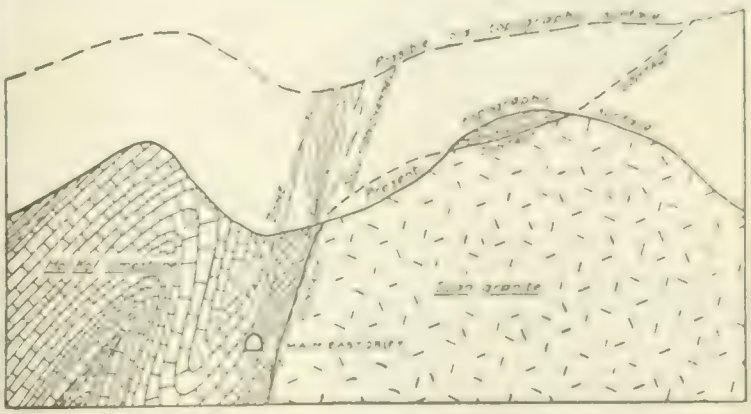
After D. F. Higgins



WESTERN GROUP OF OREBODIES



EASTERN GROUP OF OREBODIES



PRESENT AND HYPOTHETICAL FORMER SECTION OF THE SUAN MINE

After D. F. Higgins

mica, diopside, and other minerals (but no metallic sulphides), thus giving the 'formation', 'ledge-matter', or lode-channels which have always been followed at Holkol in search of ore in the eastern part of the mine. This alteration of the limestone to 'formation' is to be regarded as the final phase of the local effect of the steam of the adjacent grano-diorite, for the process of impregnation with ore belongs to a much later date, and while it doubtless owes its origin to emanations from the grano-diorite, it cannot, as can the above minerals, be directly connected with the rock. In other words, while the garnet, diopside, mica, ilvaite, tremolite, magnetite, actinolite, and other useless minerals in the 'formation' have clearly been derived directly from the immediately adjacent and underlying grano-diorite (for their formation is identical with that of the minerals on the walls of the main mass), all the evidence available shows that the metallic sulphides, gold, and silica that yield 'ledge-matter' (faintly impregnated limestone) came from a deep-seated source long subsequent to the formation of the above minerals. If it were not so, and the gold, copper, iron, zinc, lead, and bismuth were directly derived from the adjacent grano-diorite, then we would expect every foot of limestone in contact with that rock along the 23 miles of the Collbran Contact to be impregnated with metallic sulphides, but we know positively that such is not the case and that ore deposits are localized along the Contact.

"What is then the cause of this localization? In the case of the Holkol deposit and for most others known on the Concession the answer is clear. The 'formation', and, in the case of the western orebodies, the limestone have been impregnated with ore from a series of parallel fault-planes striking NNW-SSE and dipping eastward at 55°. These faults form therefore the most important physical feature at Holkol. The fault-zone that has produced orebodies is about 750 ft. wide. In this width are four principal parallel fault-planes together with several of lesser importance in regard to orebodies. This fault-zone is well marked on the surface. It has been entirely responsible for the Holkol valley, the western side of which is practically coincident with the foot-wall fault-plane. Beyond Soctarie it continues northward, the galena-silver outcrop at Eun So Kol that has been worked north of Soctarie apparently lying in it.

"A consideration of the general character of the gangue of the 'formation' parallel to the granite contact and of the fault-fissures at right angles to the same shows that they were not formed or filled at the same time. The former has the contact-minerals, mica, diopside, magnetite, etc., in abundance, and therefore represents fissures that were open when these contact-minerals were circulating in solution. These minerals are, however, absent from the members of the fault-zones which have in the main only crushed fault-rock. Both 'formation' and fault-planes were, however, impregnated by the later metallic sulphides. The order of origin and deposition is therefore: (1) formation of fissures parallel to grano-diorite contact; (2) impregnation of same with mica, diopside, etc.; (3) formation of fault-fissures; (4) impregnation of both sets of fissures with metallic sulphides."

In the Tul Mi Chung deposit, which is at present the main producing mine on the Concession, the ore-occurrence differs somewhat from the foregoing, the bulk of the orebodies being either formed close alongside a tongue of quartz-diorite which has been extruded as a later phase of the intrusion from the main granitic mass into the limestone and schist, at about right angles to the general direction of the Contact, or they are found at the flatly dipping boundary of limestone with overlying schist. This tongue of quartz-diorite divides the Tul Mi Chung mine into two portions, known respectively as the North mine and the South mine. The width of this intrusion varies from 500 to 800 ft., and its original irregularity in shape has been greatly increased by subsequent extensive faulting. It may be described roughly as a quartz-diorite in composition; it is of a much finer-grained texture than the granite of the main mass and does not exhibit the large porphyritic crystals of orthoclase that are typical of the batholith itself. The faults that governed the deposition of ore in the limestone more or less followed the general course of the quartz-diorite intrusion. As Dr. Maclaren says: "The importance of the quartz-diorite lies in the fact that the orebodies, on the whole, lie near its walls and also in the probability that ore was deposited in the limestone by metalliferous solutions that followed in the track of the quartz-diorite intrusion."

The changes in the limestone effected by the quartz-diorite intrusion are stated by Dr. Maclaren as follows:

"The limestone has been affected by the quartz-diorite intrusion for a short distance, rarely more than 100 ft., from its contact with that rock. Small irregular areas have been re-crystallized ('marmorized' or 'marbleized') by the heat of the intrusive rock, but the major part of the change in the altered zone has been brought about by solutions that followed the course of the quartz-diorite. These high-temperature solutions have formed (*a*) an irregular zone from 30 to 50 ft. wide of 'contact-rock' which is immediately next to the quartz-diorite and which is characterized by clear bluish calcite (up to two inches thick) embedded in a dull dirty-white matrix of feldspar and wollastonite. Large crystals of dark mica are often associated with the calcite. The order of deposition appears to have been feldspar and wollastonite, and then calcite and mica. This zone is not everywhere continuous along the Contact. It is best shown on the southern contact. On the northern contact its place is sometimes taken (as at No. 4 orebody) by a very fine-grained rock, containing diopside, garnet, calcite, and serpentine. Beyond the 'contact-rock' and farther away from the quartz-diorite is the ore-zone in which limestone has been largely replaced by garnet, diopside, serpentine, calcite, epidote, zoisite, actinolite, pale-green mica, magnetite, and specularite. There is a characteristic absence of silicification. In this respect Tul Mi Chung

A Korean Farmer

The Temple of Heaven at Seoul

Korean Singing Girls

A Kapsan Maiden

A Quiet Smoke

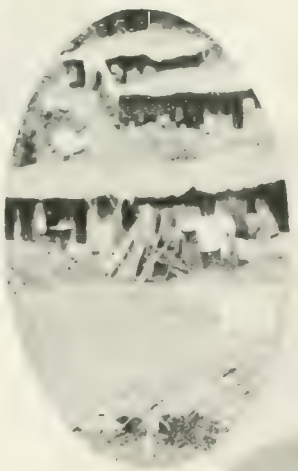
Two Contractors

A Glimpse of Pyeng Yang

Tong Ahm Mine

Sellers of Pottery

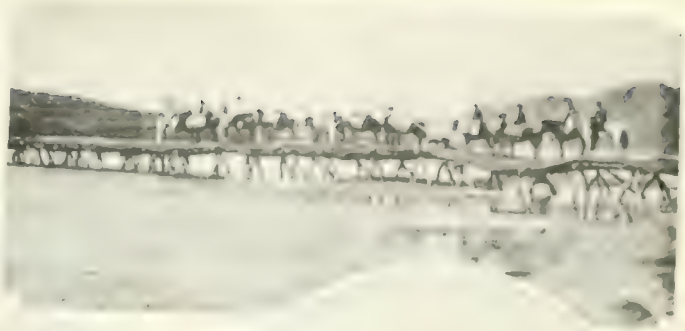
A Korean Village



Main Adit of the Tai Mi Chung Mine

Wickerwork Underwear

Pack Horses



Loading Supplies

Rickshas

Down the Yalu

Travelling in Winter

The Ferry at Pyeng Yang

Constructing the Drying-House of the Mill

A Bull Whim

Old Korean Walled City at Su Won

The Village Blacksmith

Machinery for the Mill

Excavating for a Reservoir

differs entirely from Shan. The foregoing are the gangue-minerals, and amid them, apparently as the final deposit of the hot solutions, were deposited gold, pyrite, chalcopyrite, mispickel, galena, and tetrahedrite. The two last occur together and generally at some distance from the copper minerals, giving the impression that they were the last of the metallic sulphides to separate from the ore-bearing solution. The locus of the gold has not been determined. No great amount of work has been spent on the determination of the more obscure minerals of the contact-zone. I have considered that with the comparatively limited time at my disposal it is a matter of much greater importance to outline the direction of the probable ore-channels and to attempt to arrive at some understanding of the features that govern the disposition of orebodies within these channels than to devote any time to the elucidation of points that, though of considerable scientific interest, have no obvious economic importance."

A type of orebody that has been extensively developed in the South mine at Tul Mi Chung during the last two years and also at the Tong Ahm mine, and one of increasing importance, is formed at the junction of limestone and schist dipping flatly at about 30° toward the granite. The schist overlies the limestone and has formed an impervious roof, causing the deposition of irregular bodies of ore, some of them of large size, the hanging wall of which is invariably formed by the overlying schist. With one exception, no ore has been found in the schist itself, although ore lies immediately against it. The one instance of ore having been found in the schist is at the northern end of the Tong Ahm mine, where a body of high-grade copper ore occurs in limestone and in association with an acid dike. Where the dike has intruded the schist, ore occurs in the schist itself. Dr. Maclaren says:

"The striking feature in connection with the occurrence of the orebodies already known is their occurrence beneath an overhanging roof, either of quartz-diorite, as in the case of the northern orebodies and 'B' of the southern orebodies, or of schist, as in the case of 'C' orebody. . . . It is further conceivable that the zone immediately beneath an impervious roof formed by the 'dig'* in a fault-plane would be a favorable locus for ore, though no such orebody is yet known at Tul Mi Chung."

Ore has been discovered recently in the Tul Mi Chung in the limestone at the main granite contact, formed either between the limestone and granite or more generally in the limestone close to the Contact, from which it is separated by a zone of contact-rock of an average width of about 50 feet.

The orebodies of the Tong Ahm mine almost invariably occur in the limestone underlying a roof of flatly dipping schist. In the Tong Ahm workings the influence of faults on the deposition of ore is very marked. The ore-bearing solutions appear to have flowed up through well-defined faults in the limestone, usually at right angles to the [illegible] schist contact, and deposited ore immediately under the schist.

The Soctarie orebody consists of a flatly dipping band of silicious limestone, which in places has been altered to a quartzite. The average thickness of this band is about 30 ft. It contains small amounts of gold, copper, silver, and tungsten, and although the grade is low, the size of the deposit permits it to be mined cheaply by quarrying and to be operated at a profit. The scheelite is finely divided and scattered through the ore, but in places we find bunches of an apple-green scheelite, which, from its color, was at first set down as cupro-scheelite. Scheelite also occurs as white crystals of a pearly lustre, not only at Soctarie, but also at Peh Jai, Kung Kol, Sang Dei, Tong Ahm, Tul Mi Chung, and in other mines and prospects around the Contact, although so far scheelite of an economic grade has only been found at Soctarie and Peh Jai.

Although the portion of the Soctarie band that consists of ore is some 5000 ft. away from the nearest point of the Contact on the surface, it appears to be connected with one of the main faults that run out from the granite and that have probably served as channels through which the ore-bearing solutions were brought to the present locus of the orebodies in the quartzite. The deposits in the various other mines and prospects surrounding the Contact consist of variations and combinations of the above-described types, all plainly formed as an after-result of the intrusion of the batholith into the limestone.

To be Continued

*Gouge or clay.—Editor.

MISUNDERSTANDINGS between shift-bosses and the men under them are perennial. The following letter, written by an unhappy chuteman to the superintendent, was printed in the 'Granby News', which states that as good chutemen were scarce the man was transferred to another shift-boss with satisfactory results:

"Dear Sir:—I very often heard from the Granby's employees say: that no man get along with B. Blank. Last Saturday night I found what I thought was exaggerate is perfectly true. I been worked for many bosses in this country and I noticed always that they could obtain as much and probably more work from their men without use any rough Language. We chutemen the trouble we have as: big muck, timbers, rails, pipes in the chutes headache from the powder, car off the track 10,000 compinations to get hurt. All this trouble is not enough for the money we get but we got to listen the edu-ation-less shift boss's bad words "as side dish." For the second time B. Blank offended me last Saturday night without any reason, but just because I'm Italian and also he had the mouth to talk with not because he had any brains. I told the motorman to report me off yesterday I don't like give any more chance to get me in trouble. I soon lose money than my liberty. I thank you for your valuable time you spent to read my important comunication and pardon me to not call at your office personally because I think I can explain myself better in writing and this will cause less disturb too."

Palladium in Alaskan Lode Deposits

By DONALD G. CAMPBELL

Introduction. Early in 1918, it was discovered in the course of laboratory work that the copper ore of the Goodro mine in Alaska contained, in addition to traces of platinum, a considerable amount of the even rarer metal, palladium. The find was of special importance in that palladium was in such association with other metals as to concentrate from low-grade ore with a high ratio of concentration and percentage of extraction.

The Goodro property is now owned and operated by the Saltchuck Mining Co., and will be here referred to as the Saltchuck. It is situated near the head of Kasaan bay, Prince of Wales island, and lies about 45 miles in a north-westerly direction from Ketchikan, Alaska.

The discovery of the bornite outcrop led to the location and subsequent working of the lode on the basis of its copper, gold, and silver contents. The first shipment of ore is said to have been made in 1907. Since then it has probably shipped over 10,000 tons of ore to the copper smelters, being developed and worked intermittently until the past two or three years.

With change of ownership, a 50-ton concentration and flotation mill was built and placed in operation, together with a water-power plant. The mill is connected with the mine by a gravity plane about 3000 ft. long.

Local Geology. The Saltchuck is situated among a group of copper mines that have operated steadily for the past ten or fifteen years. Of these, the best known are the Mamie, It, Mt. Andrew, and the Rush & Brown. These lie along Kasaan peninsula, a rocky promontory whose peaks rise to a maximum of 2800 ft. above sea-level. Toward its head the peninsula becomes less rugged and is connected with the island by a neck of relatively low altitude. Here occur a large intrusive mass of diorite and gabbro. In the latter, at an elevation of 400 ft., is the outcrop of the Saltchuck orebody, which forms a roughly cone-shaped knoll rising about 100 ft. above a well-defined bench. The latter apparently represents a former level of erosion.

The earliest development was by pits and open-cuts along the outcrop. Later a cross-cut was driven 90 ft. below the surface, and through this the ore is now handled from the glory-hole above. Still later a winze was sunk 100 ft. and drifts were driven from the bottom. These have opened up considerable ore additional to that shown at the surface. At the present time a 1200-ft. cross-cut is being driven from the mill-level to tap the orebody about a hundred feet below the lowest workings. Through it all the ore will be handled, doing away with the surface tramway now in use.

The geology of this district has been worked out by C. W. Wright in Professional Paper No. 87, U. S. Geological Survey. According to him the area is composed of limestone, slates, schists, and other sedimentaries of Carboniferous age. These intrusives are stated to occupy about one-third of the area of this region.

Mr. Wright, in this paper, classifies the ores of the district as primary, showing little trace of weathering or of surface concentration, and belonging to the following types:

(1) Contact deposits forming irregular masses of chalcopyrite-magnetite ore along intrusive contacts. This is the most common form. The Mamie, Mt. Andrew, and the Haida, among others, belong to this class.

(2) Disseminated deposits forming irregular masses in gabbro intrusives, and consisting of bornite-chalcopyrite ores intimately associated with the primary minerals of the intrusive rock. Secondary epidote and calcite are usually strongly developed. The Saltchuck is the only producing property of this type in the district.

(3) Shear-zone deposits occupying fissures along shearing-planes in the graywackes. The ores are galena-sphalerite mixtures in a gangue of quartz, calcite, and barite. The Rush & Brown deposit occurs mainly in this form.

(4) Vein deposits occupying fissures in the limestone and also in the granitic intrusives. This type has been prospected but as yet has yielded no ore.

The ore occurs mainly as bornite, varying from small masses to minute particles, disseminated in the greatly shattered and altered rock which forms the gangue. This rock has always been classified as gabbro, but is more particularly 'pyroxenite' and will be so referred to in this article. Mixed more or less with the bornite is chalcocite, some covellite, and occasional stringers of chalcopyrite.

The formation here is greatly brecciated and fractured, the fractures running in every direction. Slip-planes are to be seen, but no sign of extensive faulting is shown. A small diabase dike cuts the orebody without apparent effect on the latter. Many of the fracture-planes are filled with epidote, mica, and calcite, and some contain flakes of free gold. In others, the ore is to be found. Where the rock is greatly shattered, the ore may be continuous between fissures. Where the rock is more massive, the ore gradually fades to barren pyroxenite. The grade and continuity of the ore depends upon the number and strength of the fractures.

Platinum and Palladium. So far, no separate mineralization of these metals has been discovered. The platinum content is small, but fairly regular. The palladium varies approximately with the copper content in the proportion of one ounce of palladium per ton for every 8% or 12% of copper. The seams of chalcopyrite also carry

considerable amounts of it and the 'barren' gabbro is not free from mineralization. Some typical analyses are given herewith:

[illegible]	Gold	Silver	Pt and Pd	Copper,
	oz.	oz.	oz.	%
[illegible]	0.07	0.17	0.41	1.92
[illegible]	[illegible]	[illegible]	0.184	1.08
[illegible]	0.03	[illegible]	0.17	1.38
Chalcopyrite	0.11	2.08	1.01	27.66
[illegible]	1.17	4.60	3.54	43.81
Gabbro	0.01	0.10	0.01	0.06

EXTENT OF THE OREBODIES. While the ore thus far mined has come from within an area probably less than 70 ft. wide by 150 ft. long, sufficient evidence is at hand to indicate the probability of connected deposits of ore along the strike of the principal fracture-planes. The form of the outcrop indicates that the orebodies are more resistant to erosion than the non-mineralized country-rock. The knoll forming the outcrop is an isolated por-

Occurrence and Association of the Platinum

Locality	[illegible]	Principal Metal Occurring with Platinum
[illegible]	[illegible]	[illegible]
Rambler mine, Wyoming	[illegible]	Pyrite
[illegible]	[illegible]	Pyrrhotite
Sudbury, Ontario	[illegible]	Nickel
[illegible]	[illegible]	Peridotite (dunite)
Fraser Camp, B. C.	[illegible] iron sulphide	Pyroxenite
Brazil	[illegible]	Not given
Ronda mountains, Spain	Native platinum	Peridotite (dunite)
Ural mountains, Russia	Native platinum	Peridotite (dunite)

USES OF PLATINUM AND PALLADIUM. Palladium has come into economic prominence only within the past few years, and now commands an even higher price than platinum owing to the discovery that its alloys with gold and silver satisfactorily replace the latter metal for many purposes. For most laboratory utensils, in jewelry, and for dental and other industrial uses, these alloys are found to possess all the needed chemical and physical qualities for which platinum has been hitherto indispensable. Such alloys have the same silvery color, and a lower specific gravity. For equal strength they require only half the weight of platinum, are even harder, and work satisfactorily.

CONSUMPTION. Normally, the United States used 165,000 ounces of the platinum metals annually, including scrap. Of this amount, the jewelry industry uses nearly 50%, laboratory 10% to 15%, and the remainder in a variety of ways, such as dental work, electrical apparatus, magnetos, and many other purposes.

The demand for this group of metals is bound to increase with industrial development and the advance of civilization. For many purposes satisfactory substitutes have been discovered and made use of, but in many cases it appears difficult to obtain a satisfactory substitute.

OUTCROP AND GLORY-HOLE AT SALTCHUCK

tion of a well-defined ridge extending eastward, but is less pronounced for some distance west. At several places, in both directions from the orebody, mineral has been discovered, identical in nature and equal in grade to that now being mined. The surface is covered with so much soil and vegetation that systematic prospecting has been restricted.

PROSPECTS ELSEWHERE. While this is the only recorded deposit of bornite in association with gabbro or pyroxenite in south-eastern Alaska, it is far from uncommon through British Columbia and other parts of Alaska. Further prospecting and careful analysis may show other deposits of similar nature.

In this connection it must be remembered that the chalcopyrite, as well as the bornite, carries the palladium. It is probable that the criterion, in looking for further finds, should not be the bornite alone, nor even the copper minerals, but the presence of any economic minerals in a pyroxenite or gabbro gangue. The strong tendency of this group of metals to occur in basic rock of this nature is shown in the following tabulation of some of the best-known occurrences throughout the world.

The increase of demand has raised the price enormously during recent decades, but in spite of this, the total output seems to be decreasing.

This is especially true of Russia, which is by far the heaviest producer, and whose output during the past three years has been almost cut off by internal disorders. So serious does this shortage promise to become, that it is now proposed to place these metals, among others, under international control, by which the world output will be apportioned according to the needs of the respective nations.

Some tables showing the production and price for the past few years follow:

Production of Platinum and Palladium ('Mineral Resources', 1915)

Report of refiners of platinum, gold, bullion, and blister copper in the United States

	Platinum	Iridium	Ird-osmine	Palladium
1914	3,430	64	195	2,635
1915	6,495	274	355	1,541
1916	24,518	...	...	....
1917	33,009	...	...	....

World's Production of Platinum and Allied Metals in 1915

	1912	1913	1914	1915
Canada	30	50	30	100
Colombia	12,000	15,000	17,500	18,000
New South Wales and Tasmania	778	1,275	1,248	303
Russia	300,000	250,000	241,200	124,000
United States	721	483	570	742
Total	313,529	267,008	260,548	143,145

Domestic Chrome Industry Declines

Chrome mining in the United States has nearly ceased, according to reports for the first six months of 1919 received by the U. S. Geological Survey from nearly 300 correspondents who were operators or owners of chrome mines in 1918. Between January 1 and July 1, 1919, about 1400 tons of chrome ore was mined and shipped from three mines, two in San Luis Obispo county, California, and one in Wyoming. In addition 300 tons of chrome ore mined in 1918 was marketed during that period. The two mines in California appear to have been closed down, at least for the present.

This condition shows a remarkable contrast to that which prevailed in 1918, when there were nearly 600 active owners and operators of chrome properties and the total quantity of chrome ore shipped was 82,350 long tons of all grades, by far the greatest annual output of domestic chrome ore ever marketed in this country. In 1918 California produced 63,064 long tons, Oregon produced 18,455 long tons, and Maryland, North Carolina, Washington, and Wyoming produced the remainder. Georgia, Montana, and Pennsylvania produced some ore in 1918 but did not ship any.

The ore shipped in 1918 ranged in content of chromic oxide from less than 35 to more than 45% and averaged 41.7%. Most of the ore shipped during the first six months of 1919 has ranged in content of chromic oxide from 34 to 51%, that from California being of the better grade. The average price of the ore mined in 1918 was nearly $48 per ton. The price of the ore sold in 1919 ranged from $13 to $63 per short ton, and the average price was nearly $26 per ton.

The ore imported from overseas is reckoned as of 50% grade, and the total quantity of domestic ore shipped in 1918, if calculated as containing 50% of chromic oxide, would amount to 68,680 long tons. In addition to the large quantity of domestic chrome ore shipped in 1918 there was 42,687 long tons mined, but not shipped or sold, remaining in the hands of the miners December 31, 1918. The War Minerals Relief Commission is now investigating the claims of miners for losses incurred.

The imports of chrome ore during the first half of 1919 amounted to 19,658 long tons. Nearly half of it came overseas from Oceania, and the average price of the ore in the country of its origin is reported to have been about $36 per long ton. The decline in the domestic production and market in the first half of 1919 is general and overwhelming, sparing only localities favored by cheapness of local transportation, high grade of ore, or cheapness of production.

Imports to United States

	1914 Oz.	1914 Value	1915 Oz.	1915 Value	1916 Oz.	1916 Value	1917 Oz.	1917 Value
Platinum crude and unmanufactured	72,032	$2,934,080	61,438	$2,341,476	53,522	$3,138,087	30,207	$2,408,188
Platinum manufactured products	....	46,533	....	73,799	....	21,872	1,347	....
Iridium	1,785	112,430	4,158	243,266	3,346	250,705	3,619	378,678
Osmiridium	1,348	84,363	130	5,737	414	17,241	259	25,456
Osmium	.....	.....	32	787	....	....	400	23,359
Palladium	1,613	69,547	3,020	103,623	6,513	282,910	1,239	117,192
Rhodium	32	1,905	.....	.....	.....	.....	.....	.....
Total	76,810	$3,248,858	68,778	$2,768,688	63,795	$3,710,815	37,071	$2,952,873

Russian Platinum Product ('Mineral Industry', 1917)

Year	Oz.	Year	Oz.
1899	380,900	1908	250,000
1900	212,500	1909	275,000
1901	315,200	1910	300,000
1902	380,800	1911	275,000
1903	226,000	1912	300,000
1904	290,120	1913	275,000
1905	200,450	1914	240,000
1906	210,318	1915	124,000
1907	310,000	1916	90,000
		1917	50,000

Price of Platinum (Fahrenwald)

1874	6.12	1907	28.00
1888	8.19	1910	32.70
1890	8.67	1911	43.12
1893	9.19	1912	45.55
1895	10.22	1913	44.88
1898	17.88	1914	45.06
1900	19.41	1915	49.63 to 85.50
1901	19.93	1916	85.50 to 110.00
1902	20.94	1917	
1905	21.45	1918	*105.00
1906	27.00	1919 (March)	97.50

*By Government regulation.

Thanks are due to the owners of the property for permission to use and publish the above data. H. R. Chilberg, of Seattle, is general manager for the company, Fred Chapman, superintendent in charge, V. Gleason, mill-foreman, and A. L. Howard is chemist and assayer. Andrew G. Larson, of Spokane, is consulting engineer for the company.

Chicago Meeting of the American Institute of Mining and Metallurgical Engineers

By Our Own Correspondent

The Chicago District

Those members of the Institute who attended the 120th meeting at Chicago and who made the trips to the various industrial plants and mines of that vicinity made the acquaintance of some of America's foremost industrial institutions. Chicago, the second American city and greatest railway centre in the world, has within the last fifteen years gained world prominence in the iron and steel industry and it was around this industry that this meeting of the Institute was largely planned.

Chicago's position on the main lines of the national trade-routes and its splendid accessibility to both ore and fuel has resulted in a national development of the iron and steel industry in this district. The first discovery of coal in the United States was made in Illinois as shown by Joliet's map and Margry's account of Joliet's voyage. "The said Joliet adds that he set down in his journal an exact Description of the Iron Mines they discovered as also of the Quarries of Marble and Cole-Pits, and places where they find Salt-Petre with several other things." During the pioneer days at the beginning of the 19th century coal was mined in Illinois where it outcropped. The development of the Illinois-Wisconsin lead and zinc deposits, which were originally worked by the Indians, played a large part in the development of the Mid-West.

The Lake Superior district contains about 70% of the available iron ore and 95% of the low-grade reserve ore-supply of the United States. The U. S. Geological Survey estimates the tonnage of available ore at three and a half billion long tons and of low-grade reserve-ore at 72 billion tons. A part of the ore is smelted in the Lake Superior district but the bulk of it goes to lake-shore points and to Pittsburgh. Of some 64 million tons of ore mined in the Lake Superior district in 1916 about one-fifth was received at Lake Michigan ports, Gary and South Chicago receiving about 10 million tons.

At Gary the U. S. Steel Corporation has 12 blast-furnaces, two Bessemer converters, and 46 open-hearth furnaces, besides mills for making various steel products. The corporation also operates a large by-product coke-plant. The Inland Steel Co.'s plant covers 245 acres and a mile of lake frontage. The South Chicago Works of the Illinois Steel Co. has 11 blast-furnaces, three Bessemer converters, and 35 open-hearth furnaces. This company has been a pioneer in the development and use of large electric furnaces. These are but a few of the steel manufacturing plants in the Chicago district. There are fifty or more iron and steel companies that do not reduce ore, such as the American Bridge Co., American Sheet & Tin Plate, Republic Iron & Steel Co., Interstate Iron & Steel Co., the Steel & Tube Co. of America, American Steel Foundries Co., Standard Forgings, and the Crane Co. the largest manufacturers of valve-iron in the world.

The eastern interior coalfield comprising Illinois and western Indiana and the northern interior coalfield, which is entirely within the boundaries of Michigan, hold the coal reserves closest to the Chicago region. The seams lie at shallow depths, only one mine being 1000 ft. deep, and stripping mines are common in some districts. The veins are persistent over broad areas, many of them average four to six or seven feet in thickness with a maximum of ten feet or even more. The coal is sub-bituminous to bituminous in quality and generally relatively high in sulphur. In 1917 Illinois and Indiana produced 86 and 26½ million tons respectively and Michigan over a million tons.

The coke industry of the Chicago district has kept pace with the iron and steel industry. At present 980 ovens are in operation. The U. S. Steel Corporation has 700 Koppers ovens capable of coking 12,000 tons of coal per day. More than 2000 ovens are in use in the four Lake Michigan states.

The lead and zinc smelters, with one exception (the plant at Mineral Point, Wisconsin), are located outside the pre-production area. The others are in the coalfields at Hillsboro, East St. Louis, Collinsville, Danville, Peru, La Salle, Depue, Springfield, and Alton; and a refinery in the Indiana portion of the Chicago-Gary district. The processes used are well known to metallurgical engineers. The ore is roasted in kilns to remove the sulphur and transform the zinc content to oxide. The kiln is known generally as the Hegeler and has been adopted widely throughout the country. The sulphur gases are used in the manufacture of acid and the zinc oxide is treated in retort-furnaces.

Among the companies engaged in the refining of non-ferrous metals, the production of alloys and the like may be mentioned, the Fansteel Products Co., the Great Western Smelting & Refining Co., International Lead Refining Co., United States Metals Refining Co., and others. Two refineries are located in the Chicago-Gary district, namely, that of the Standard Oil Co. at Whitney, with a capacity of 35,000 barrels of crude petroleum per day; and that of the Sinclair Refining Co. at East Chicago with a capacity of 6500 bbl. per day. The output of asphalt from the refineries in the Chicago district during 1917 was over 100,000 tons.

The fluorspar deposits of Hardin county, Illinois, are among the largest and purest in the world. Practically

the entire American market is supplied with spar as flux for foundry work and steel manufacture from this Illinois-Kentucky district.

The copper districts tributary to the Chicago district are confined to the upper peninsula of Michigan where the ore is mined, milled, and smelted. In 1917 Michigan produced about one-fourth the total output of the United States.

Gypsum is a mineral product distinctive of Michigan, where apparently inexhaustible deposits are found. Some of the largest beds are about 25 ft. thick. Most of the output is calcined for stucco, mixed wall-plasters, plasterboard, building-block, calcimines, and other products.

The lead and zinc districts tributary to Chicago are those of north-western Illinois and south-western Wisconsin, and Hardin county, Illinois, where some lead and zinc are found in association with the fluorspar. In 1917 the lead production was valued at about one million dollars and the zinc production at thirteen million dollars.

The Chicago district has long been prominent in the manufacture of mining, milling, and smelting equipment. The products from numerous local plants have a world-wide distribution and are well known to the readers of the 'Mining and Scientific Press'. Some of the visiting members availed themselves of the opportunity while at Chicago to become better acquainted with the companies that have been supplying their mines and mills with equipment. Among the best known manufacturers of machinery for use in metal mining and the allied industries in the Chicago district are the Allis-Chalmers Co., American Spiral Pipe Works, Chalmers & Williams, Chicago Pneumatic Tool Co., Deister Concentrator Co., Deister Machine Co., Dings Magnetic Separator Co., Siebe, Gorman & Co., Fairbanks, Morse & Co., Flexible Steel Lacing Co., Harring & King Perforating Co., O. F. Jordan Co., Justrite Manufacturing Co., Marathon Mill & Machine Works, Nordberg Manufacturing Co., the Sullivan Machinery Co., Western Wheeled Scraper Co., and the Wood Equipment Company.

In compiling this summary of the Chicago district as related to the mining industries, I acknowledge gratefully the co-operation of F. W. De Wolf of the Illinois Geological Survey, who was largely responsible for the splendid guide-book placed at the disposal of the members in attendance.

Papers and Discussions

A glance through the program of papers presented at the recent meeting emphasizes the wide scope of the activities embraced in the membership of the Institute. The many ramifications of the engineering profession represented in the Institute have been so specialized by the present generation of engineers as to make it quite evident that the general practitioner is archaic. A list of the papers presented in person, by proxy, or by title at the Chicago meeting would mean but little to the average reader or engineer whose day is devoted to the mining, milling, or smelting of ore.

Such subjects, while treated with a wealth of detail and in a most commendable manner, as 'Deterioration of Nickel Spark-plug Terminals in Service', 'Heat Treatment of Duralumin', 'Mud Volcanoes of Colombia', 'Aircraft Steels', 'Erosion Tests of Rifle-barrels', 'Cooling Properties of Technical Quenching Liquids', 'Occurrence and Origin of Finely Disseminated Sulphur Compounds in Coal', 'Water and Chlorides in Cement Copper Briquettes', 'Pyrometry in the Tool-manufacturing Industry', and so on through the list to the 'Temperature of a Burning Cigar', while not making a general appeal, may be of interest to the chosen few and are perhaps worthy of a place in the ever-increasing library of technical literature. Possibly the 'Temperature of a Burning Cigar' should not be included among those of interest to the few, as most of us concede with Kipling that a "good cigar is a smoke."

The predominating note in the technical sessions was iron and steel, and their associated or allied industries. The Iron and Seel sessions proper covered various phases of the physical and chemical properties of steel and iron, heat treatment and metallography. The fabrication of steel also received attention in papers dealing with rails, tubing, and plates; the practice at the 'World's Largest Plate Mill' by C. G. Huston and the 'Manufacture of Steel Rails' by Robert W. Hunt being of particular and general interest.

The symposium on Sulphur-Coals embraced 13 papers covering a wide variety of topics; in their entirety these constitute a notable addition to the literature of the subject. The papers on the geographic distribution, occurrence, and origin of finely disseminated sulphur compounds, the geological aspects and forms in which sulphur occurs, formed a foundation for the subsequent papers dealing with the mechanical separation of sulphur minerals from coal, the removal from illuminating gas, sulphur in the coking process and in producer gas. The commercial recovery of pyrite and the effect of sulphur in coal used in the ceramic industries completed the discussion of the subject.

The symposium on Pyrometry was most elaborate, consisting in all of 53 papers. To attempt a summary in the space afforded would be akin to the effort of inscribing the Lords Prayer on the head of a pin. Those who are interested in pyrometry will find this symposium, which was prepared in co-operation with the National Research Council of the U. S. Bureau of Standards, a valuable work of reference. It is to be hoped that it can be published as such and so kept intact for future use. The seeker after information will find there a detailed discussion of every branch of the subject from the 'Fundamentals of Pyrometry' to the 'Temperature of a Burning Cigar'.

The session on Non-ferrous Metallurgy included an interesting paper by Charles H. Fulton on the 'Electric-resistance Furnace of Large Capacity for Zinc Ores' and a paper on 'Electrolytic Zinc' by C. A. Hansen. The 'Treating of Antimony Ores' was presented by George P. Hulst. 'Water and Chlorides in Cement Copper Briquettes' by Edward Keller and 'Chemical and Electro-chemical Problems Involved in New Cornelia Copper

Company's Leaching Process by Henry S. Mackay were presented by title.

The session on Non-ferrous Metallography was devoted to a discussion of the papers which were read by title only and were presented at the Philadelphia meeting of the Institute of Metals division on September 29. In all, 15 papers composed this group. The session on 'Mine Taxation' was extended over two days with four sessions and was in many respects the most important of the meeting. A detailed report of this session will be found elsewhere.

The Coal and Gas session was devoted primarily to Middle-West problems as regards engineering practice in Illinois and Indiana. Gas-producer practice and the testing of coals for by-product coking and gas manufacture, and other kindred subjects came up for discussion.

The Wisconsin zinc district was described in a paper by W. F. Boericke and T. H. Garnett; and the 'Mineral Resources of the La Salle District' by J. A. Ede at the session on 'Mining and Local Resources'. Other papers included 'Mining Methods of Alaska Gastineau Mining Co.' by G. T. Jackson, 'Tunnel-driving at Copper Mountain, B. C.' by Oscar Lachmund, 'Wedging Diamond-drill Holes' by O. Hall and V. P. Row' and the 'Geology and Mining Methods at Pilares Mine' by W. R. Wade and Alfred Wandtke.

The session on Geology was devoted to sundry articles on subjects pertaining largely to the secondary minerals, such as 'Chrome-ore Deposits in Cuba' by Ernest F. Burchard; also 'Manganese-ore Deposits in Cuba', by the same author. J. S. Diller presented a paper on 'Recent Studies of Domestic Chromite Deposits'. A paper by C. D. Dolman on 'Magnesite, its Geology Products and Their Uses' was presented by title. 'Recent Studies on Manganese Deposits', by E. C. Harder and D. F. Hewett, was also presented. The session on Milling was devoted to four articles and their discussion. 'Chilean-mill Practice at Portland Mill' by Luther W. Lennox; 'Graphic Metallurgical Control', by H. M. Merry; 'Mill Operations at the United Eastern during 1917-'18', by Wheeler O. North; and 'Crushing Practice at New Cornelia Copper Company', by W. L. Dumoulin, published in our issue of August 30.

The session on Oil was made up largely of papers dealing with oil-producing districts and the production of petroleum, papers being presented by title in large part. 'Value of American Oil-shales', by Charles Baskerville, introduced a subject of considerable interest.

The session on Industrial Organization was limited to papers by C. F. Willis on the practice at the Copper Queen property; these were read by T. T. Read. The subject of industrial organization is coming to be one of steadily increasing importance to mine-operators by reason of complex labor problems and the necessity for the utmost efficiency. The Copper Queen is one of the companies that has taken particular interest in the subject, and the account of some of their methods was most timely. The discussion was most interesting and was participated in by A. M. Plumb, C. H. Benedict, Robert Ammon, T. T. Read, and others. The discussion of the bonus and dividend systems at Mascot, Tennessee, and the Wisconsin Zinc Co. were of special interest.

The technical program was one of the most elaborate that has been presented at any meeting of the Institute. A greater number of papers were offered at the present meeting than at any previous one. While coal, iron, and steel occupied the centre of the stage, there was a number of papers of no little interest to the metal miner in the sessions on taxation, milling, and industrial organization.

It was to be regretted that the trip to Gary was necessarily declared off because of the steel strike. The trips to La Salle, the Franklin county coalfield, North Chicago, Milwaukee (as guests of the Allis-Chalmers Co.), East Chicago, and numerous sight-seeing trips for the ladies were all well attended and much enjoyed. So many different kinds of mining and metallurgical plants are located in the Chicago district that the individual preference as to the class of operations could be satisfied in almost every instance by the program provided. As the secretary, Bradley Stoughton, stated at the banquet, it was very much the consensus of opinion among those in attendance at the meeting that the Chicago meeting will go on record as one of the best planned and best attended in the Institute's history.

Mine Taxation

The discussion of Mr. Graton's paper extended over three sessions, it being felt by those in attendance that the subject was of such vital importance at this time as to warrant the additional sessions and give the members an opportunity to express their views not only before the meeting but also to Mr. Graton of the Bureau of Internal Revenue. It is gratifying to call attention to the attitude of mind on the part of the director of the Bureau and of his associates who are exceedingly anxious to have a thorough ventilation of this subject by the mine operators and the benefit of their advice. When it is considered that there are 35,000 producing mines to be valued, all of which are different one from another, the task confronting the Bureau is stupendous. A corps of engineers is being organized and the industry will be divided according to the various classes of mining work, that is, iron, gold and silver, lead and zinc, copper, etc. The engineers who are most familiar with the various classes of mines will be assigned to their sub-division of the work in valuation. It is recognized to be impossible to do all this work in the field, hence the mine operators themselves will be relied upon in large part for data and assistance.

The Bureau recognizes the difference in coal and metal mining operations, coal mining being more nearly in line with the manufacturing industries than is the metal mining branch, although no exact parallel is possible. R. V. Norris of the War Industries Board brought out a number of interesting features of coal mining as related to the present law, that is, the leasing system, simplicity of the mining problem, and valuation of properties, the mining risk as to coal supply, and the various hazards as

to gas, dust, and explosions. He pointed out that coal reserves to be mined a long time in the future, should not be considered as reserves that are commercially available and of fixed value, because the character of operating conditions 25 or 50 years hence cannot be foreseen. He showed the difficulty of supplying maps in connection with valuation reports. On the scale of one inch to 100 ft., as required, many properties with which he is familiar would need a special building in Washington in which to file them. He believed that 6% plus a fair rate of amortization was a reasonable return on an investment in coal mining.

It was also brought out in discussion that where two properties are almost identical as to physical features, it often happens that one is a good dividend-paying investment, while the other is not, the difference being due largely to management. The question is raised as to whether it was fair to penalize efficient management in the way of taxation. The war years, it was contended, could not be used as a proper basis for valuation of properties because of the abnormal conditions then prevailing. Operating conditions up to 1913, that is, the tonnage produced, is suggested as a fair basis for estimating future operations. The difficulty that might arise from unfair local valuation was discussed.

W. O. Hotchkiss emphasized the importance of having the proper personnel in the Internal Revenue Department to conduct examination work. He pointed out that it was almost impossible to get capable men for these positions at the salaries the Government was willing to pay, and urgently recommended that adequate remuneration be available to secure the type of men needed to do the work properly. He also touched upon the importance of the problem of fixing the interest-rate on valuation together with discount-rates. The regulation of the Bureau requiring a valuation 30 days after discovery brought up the query of when is a mine discovered and how can the date be fixed. This subject was discussed energetically by various members and occupied a good part of a session. This ruling was made originally to apply to oil and gas properties and it seems that through ignorance it was made also to apply to mines. While no definite ruling is available in regard to this question, it seemed to be the concensus of opinion at the meeting that a mine was discovered when a sufficiently large orebody had been clearly defined and mining operations commenced. The meeting was assured that it was not the purpose of the Bureau to require the impossible of mine operators and that their procedure must necessarily be governed by experience and the conditions peculiar to each case.

William Belding, a lawyer connected with Cleveland-Cliffs Iron Co., reviewed the various tax laws from 1909 to 1918 and pointed out some of the difficulties of their incidence. He pointed out that the three important elements entering into the tax law are income, excess profit, and capital stock. As against these, the deductions allowable are depletion, invested capital, and the market-value. As regards invested capital, he discussed the different practices of various companies, some of which showed no relation between capital stock and assets, the properties being decidedly over-capitalized, as against companies which have a conservative management, whose tendency is in the opposite direction. This matter of capitalization is one that tends to create an unequal balance between tax-payers, and, as such, was contended to be unfair.

Paul Armitage, a lawyer from New York, also discussed Mr. Graton's paper with special reference to the matter of depletion. The Government regulations, it seems, allow but one method of calculating depletion, that is, a uniform depletion based on available tonnage and the life of the mine. He insisted that this in unfair, because the rate of depletion is not uniform and it is a matter subject largely to local conditions. In a great many properties, the first few years of operation show the greatest depletion while in others it is toward the end of the life of a mine that depletion is greatest. He contends that what is stated in the law of 1918, namely, "a reasonable depletion according to the peculiar conditions," cannot be applied under the present Federal regulations. He recommended that rulings as to the calculation of both depletion and depreciation must be made so as to apply them equitably.

In the course of discussion, it was moved and carried that the president of the Institute be asked to appoint a committee on 'Mine Taxation' to confer and co-operate with the Bureau of Internal Revenue. It is hoped that through this committee the Institute will bring to the attention of the Bureau of Internal Revenue from time to time various suggestions and recommendations for the administration of the Federal taxes on mines.

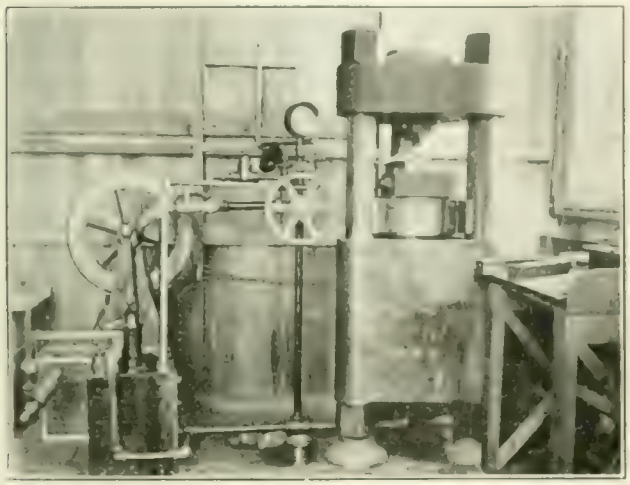
The Refining of Tungsten and Molybdenum

One of the most interesting of the trips taken by Institute members was to North Chicago to visit the tungsten and molybdenum refinery of the Fansteel Company. The refining of the rare minerals has been kept very much a secret, therefore we are much indebted to Dr. C. W. Balke, the chemical director of the Fansteel Company, for his liberal policy in giving detailed information regarding the process and also for the description, which follows.

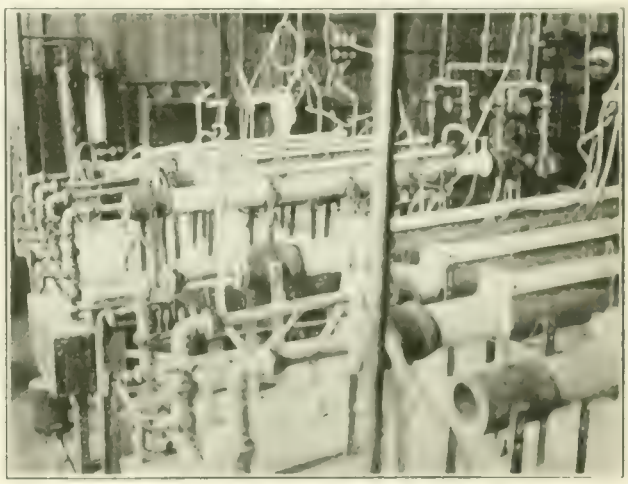
Metallic tungsten for many metallurgical purposes is rather easily produced at a low cost by various methods, but to obtain an exceptionally pure metal suitable for the fabrication of electrical devices a different method and a much more expense one is necessary. The Fansteel Company requires a purity in its metal of over 99.75% and its actual product varies between 99.9 and 99.95%. The impurities in the final product consist of alumina, iron, and calcium oxide. The process of manufacturing tungsten of this purity begins with the ore. Almost any ore can be used, but it is economical to use a high grade of wolframite.

The ore is crushed in a disc-mill and further pulverized in a pebble-mill until it will all pass through a 100-mesh screen. About half its weight of soda-ash is added to the finely divided ore and the mixture is fused in a gas-furnace. The time for fusion varies from two to

three hours. The charge in the furnace is raked frequently during the fusion. When this operation is complete, the mixture is drawn onto an iron tray, broken, crushed, and ground again to 100-mesh and fused a second time. The crushed melt from the previous process is then leached with water in wooden tanks provided with agitators, the process being continued until a nearly saturated solution of sodium tungstate is obtained. This is passed through a filter-press. The filtered liquid is heated in a stoneware kettle or wooden tank, where it is stirred with a solution of calcium chloride until all the tungsten is precipitated as calcium tungstate. The calcium tungstate is washed with distilled water by decantation and is then decomposed, either in a wooden tank or in a stoneware kettle, with



PRESS USED TO MAKE BARS OF TUNGSTEN FROM THE POWDERED METAL.



ELECTRIC FURNACE FOR REDUCING TUNGSTIC OXIDE TO METAL.

muriatic acid, the acid being heated to boiling with a steam jet and the calcium tungstate added gradually. This is boiled for 20 to 30 minutes. The tungstic acid settles out as a bright-yellow precipitate and the clear liquor containing calcium chloride is drawn off and used in further operations.

The tungstic acid is then washed with distilled water, first by decantation and finally in a stoneware suction-filter a number of times. After being dried for a short time it will contain approximately 50% moisture. This process should yield 85–95% of the tunstic acid that was in the original ore. As thus produced it frequently contains as much as 0.6% of iron and several other impurities, and is unsuited for the production of pure metal.

The crude tungstic acid is dissolved in boiling dilute ammonium hydroxide. If the solution is too concentrated the salt will crystallize in the filter-press and clog the filter-leaves. This solution is permitted to stand and settle for an hour or more, and is then filtered until absolutely clear. The greatest care must be taken in this process to keep all the equipment entirely free from dirt.

The clear solution is evaporated in steam-kettles until almost dry. The salt (ammonium para-tungstate) is removed from the bottom of the kettles and the process repeated with more pure. The moist ammonium tungstate is washed several times with distilled water and dried on a suction-filter. The moist ammonium para-tungstate is treated with a mixture of concentrated nitric acid, hydrochloric acid, and water and then boiled gently. The tungstic acid resulting from this decomposition is washed with distilled water and then dried as completely as possible. Any degree of purity may be obtained by repeating this process a sufficient number of times. To produce the oxide from which the metal is made later the acid is ignited in silica crucibles either in a gas or an electric furnace until a heavy green oxide is obtained.

The oxide is reduced in an atmosphere of hydrogen in furnaces of special design. By controlling the temperature and the time of reduction the fineness of the metallic powder may be controlled. This fineness has a definite influence on the ultimate crystalline structure of the tungsten.

To produce the ingots from which worked tungsten is made, the powder is loaded into dies and compressed under extremely heavy pressure. The resultant ingots or bars are very fragile, very heavy, and quite hard. They are converted into ingots by a heat treatment known as sintering, which is also done in specially designed electric furnaces. The metal is heated to a temperature that permits the growth of crystals and not far below the melting-point. There is considerable shrinkage during the sintering process but no loss of weight, except where oxygen has had access to the heated bar. To prevent oxidation and ensure complete reduction, a hydrogen atmosphere is maintained in the sintering-furnaces.

Molybdenum is treated in a similar way. Because of its lower melting point, it is possible to reduce the oxide of molybdenum in a gas-furnace instead of electric furnaces; and the metal itself is softer, less brittle, and much more ductile. It oxidizes readily at the high temperatures necessary for working, and the furnaces designed for its use have a constant stream of hydrogen flowing through them.

It has been necessary for the Fansteel Company to design and build most of the equipment used in the processes. Undoubtedly great improvements will be made in due course and it may be possible to eliminate some of the intermediate processes without interfering with the final results.

The Smoker

This, like previous gatherings of the same character, was marked by good-fellowship, an opportunity being given to rub elbows and chat informally. The present meeting marked a departure from precedent in that the ladies occupied the mezzanine floor of the hall and with their husbands and friends enjoyed the festivities. Several hundred members attended the smoker and the program was rich in surprises. At the start the Secretary, Bradley Stoughton, took pleasure in introducing Dr. Eu Chin Chan, who was announced as prominent in the mining activities of the Orient and as coming with credentials from H. Foster Bain. It was stated that Dr. Chan was making a tour of this country in the company of his secretary and interpreter. E. Gybbon Spilsbury had taken a kindly interest in Dr. Chan and had introduced him to members. Dr. Chan appeared in native costume and made a short address in Chinese, this being warmly applauded. While his secretary was translating his address, a commotion in the rear of the hall was occasioned by the entrance of an undesirable person who was minus a coat and collar and who boisterously interrupted the meeting by searching for someone against whom he had a decided grievance. Finally, making his way to the front, he discovered Dr. Chan and immediately proceeded to accuse him of being his laundry-man who had defaulted with his last week's wash. As Dr. Chan and his secretary made a hurried retreat from the hall, amid laughter, it became evident that the audience had been pleasantly fooled.

The illustrated talks by Messrs. Rice and Cottrell on their recent trip to the devastated areas of France, with particular reference to mine operations, were of exceptional interest and brought home to members the enormous handicap under which the mining industry of France starts its reconstruction. Dr. Cottrell's talk on the harnessing of volcanic activity in northern Italy and the conversion into power of this source of energy was exceedingly interesting. In this district the fumeroles have been tapped by pipe-lines which bring the steam to the central power-house, where 800 hp. is generated in low-pressure steam-turbines. He stated that it had been estimated that at least 100,000 hp. was available from this source of supply in one locality alone. In view of the high prices of fuel and its scarcity in Italy, this source of power promises to be one of real economic importance and offers a big field for future development. He also directed attention to the helium content of gases as found in the fumeroles of this district and the possibility of their importance from this standpoint. Dr. Cottrell's talk was splendidly illustrated with slides, which gave his audience a realistic impression of the work being done in that district.

Sidney Smith, the originator of the Gump family, so familiar to readers of the Chicago 'Tribune', entertained the audience with caricatures of some of the Institute members. H. T. Walsh's one-act comedy entitled 'The A. I. M. & M. E. (Almost Incorporated Mining & Milling Enterprise) was productive of no little merriment, particularly among those intimately acquainted with the *dramatis personae*. The subject was J. D. Oil's enterprise, in which Mr. Walsh introduced Horace V. Winchell as office-boy; John Hays Hammond as engineer; H. C. L. Hoover as boarding-house proprietor; Sidney Jennings as mine-superintendent; John D. Ryan as capitalist; also D. C. Jackling and L. D. Ricketts; Mrs. Bradley Stoughton as stenographer; T. A. Rickard as advertising manager; and others well known to the profession.

A buffet luncheon was served and it was amply demonstrated that there is as much good fellowship in a stein of less than 1% as in anti-prohibition beverages.

The opportunity afforded by the Institute meeting for social intercourse is a phase of these foregatherings the importance of which cannot be over-emphasized. Indeed, a large part of the members who attend the meetings are interested in but a small percentage of the technical papers and discussions, which are outside the scope of their personal experience. There is this one common ground, however, on which all can meet, and that is the fraternization of co-workers. In this respect the present meeting fully lived up to the standard set in the past.

The Banquet

Close to a thousand members and guests of the Institute attended the banquet. The human and non-technical side of engineering work was the key-note of the speeches made by the president, Horace V. Winchell, Theodore W. Robinson, vice-president of the Illinois Steel Corporation, and the principal guest—the 'Star of Bethlehem' as designated by Mr. Robinson—Charles M. Schwab.

Mr. Winchell took as his theme the prevailing attitude of engineers toward civic affairs and the lamentable fact that more engineers did not take an active interest in public affairs but confined their activities closely to the work of their profession. He spoke of the enormous opportunity offered at the present time to engineers as a body and as individuals in the public work of our country and of their splendid qualifications for the performance of such work in connection with national or local affairs. At the present time, when our national life is entering upon a period of reconstruction and problems of great weight must be met and solved by the American people, there is no class of men better qualified to take a hand in this work of reconstruction than the engineers; and he urged that the engineers individually and collectively should not shirk this duty or pass the responsibility to another but become a part, as much as their circumstances would permit, of the force that will mold public opinion and shape national affairs.

F. S. Peabody made a plea for the modification of the Sherman Law as it affects inter-state commerce in coal or else the enactment of national legislation equalizing competition in all the States. He also spoke upon the conservation of mineral resources, particularly coal, and urged that legislation be enacted that would penalize mine operators who were robbing the earth and the generations to come by their wasteful methods.

Theodore W. Robinson responded eloquently to the toast of 'Chicago—the city of destiny'. In closing his eloquent address, he called attention to the fact that as "an aftermath from the War we are faced with momentous social changes, which in their extent and intensity are unparalleled in history. To fail to recognize their power is to endanger not only our industrial supremacy but the very stability of our institutions. The causes of our social discontent are partly psychological and partly economic. Ninety-nine per cent of our men are innately honest but they are at the same time innately selfish. The danger lies not so much because labor is asking a larger share of the fruits of its industry, but because, wilfully or otherwise, this share is so often sought in violation of economic law and sometimes in defiance of statute law. The distinction between a man unjustly taking the property of another man and a man obtaining a larger part of what he may produce is the difference between robbery and increased industrial reward. That the ethics of this distinction sometimes rests lightly, even in high circles, is occasionally evidenced by actual or proposed vicious class legislation. The burning questions of the hour are the high cost of living, higher wages, and shorter hours. Throughout the land there is strike on strike; H. C. L. has become a social as well as a chemical symbol. Both spell corrosion, but with the essential difference that hydrochloric acid is the handmaiden of industry and the high cost of living is apt to be the handmaiden of energy. In many trades and industries, the increase in wages has more than reasonably off-set the increase in living costs, but the demand for shorter hours fails to recognize the vital necessity for maximum output at a time when the waste of war as well as current need must be met. The power of example is, of course, second only to the resultant power of public opinion. If our last constitutional amendment may serve as a lesson, why not then, as with prohibition, make the necessity of increasing industrial efficiency and the exercise of personal economy a moral issue? If there could be developed against the spendthrift and industrial shirker a popular sentiment akin to that which during the War obtained against the army slacker, the high cost of living and our social unrest would soon disappear. Our people are sovereign in their power. If knowledge and clear thinking do not lead, ignorance and blind self-interest will. If you believe that the throes of the present world-wide social revolutions are fraught with danger to our traditions, to our rights of property, and to our institutions, then it is your duty—you men of the Institute—to preach in all cities and throughout the land the gospel of hard work, thrift, and loyalty. How vitally necessary is such action is demonstrated by the wide and nationally momentous strike that has been inaugurated against the United States Steel Corporation and other interests. The steel strike is foreign radicalism transplanted. It is not based upon a demand in respect to wages or working conditions. It was distinctly predicated upon forcing the principle of the 'closed shop' upon this country, and the later formulation of grievances will in no wise mislead nor detract from the vicious attack upon the rights and freedom of our people. Judge Gary recently declined to meet certain labor leaders because he rightfully did not feel that they were authorized to speak for a large number of employees, and because a conference with them would have been treated as a recognition of the 'closed shop' principle. The United States Steel Corporation has always stood for the 'open shop', and union men and non-union men have satisfactorily worked side by side in its mills for years. The corporation feels that the principle of the 'open shop' is vital to liberty of conscience and freedom of action and a benefit to both employer and employee. It believes that the country will not stand for the 'closed shop' because it means decreased production, stunted initiative, and high cost of living. The present contest marks a grave crisis in the industrial history of our country. It is not a fight for the right to unionize nor against the right to unionize. It is a fight of a militant minority to try to force class distinction and power upon a peaceful majority. It is a conflict upon the result of which will largely depend whether four million organized men shall dictate to twenty-five million un-organized men how they shall work, where they shall work, or whether they shall work at all. This is not Americanism, it is not true unionism, and I have faith that the patriotism and common-sense of the American people will see that right and justice shall prevail."

Mr. Robinson's remarks were warmly applauded, and while Mr. Schwab has up to this time refused to make any comment upon the present industrial situation as regards the steel industry, it was to be noted that Mr. Robinson's remarks were applauded by him.

The Institute is to be congratulated upon having had with them, as the guest of the evening, Mr. Charles M. Schwab, it being the only occasion upon which he has consented this year to appear at a banquet. However as he stated, when he received a letter from his old friend Captain Robert W. Hunt, he said to his good wife that it was impossible for him to refuse Captain Hunt anything and he would take pleasure in going to Chicago and talking to the Institute members at their banquet. Mr. Schwab's address was devoted in large part to what he pleased to call 'human engineering'. His talk was interspersed with humorous stories and anecdotes which kept his audience amused as well as interested. He stated, in part: "The engineers of this country have placed this great country of ours in a pre-eminent position with everything pertaining to manufacture, metallurgy, and the kindred arts. We are second to none in this world. We have a great country which God has endowed with such riches in natural resources as no other country in the world, but rich as these are when viewed

by you, the engineers of the country, there is one thing greater than these resources and that is the sturdy character, energy, and integrity of its people, which will make these great resources of influence in the world's development. There is one problem of our engineering that I term today 'human engineering', which is of far more importance than the creation of machines and methods with which you have been so successful in the past. Of what value is the skilfully devised machine and the complex process unless manned and operated by people whose heart and soul is in sympathy with the work which they are doing and whose purpose is the giving of a complete day's work for a day's pay. I have often heard of so-called German efficiency. We have before, and especially during the War, heard of the efficiency of German methods. Germany is the second-largest steel-producing country in the world and yet with all their production and ability there has not been a single great invention or process in the development of iron and steel that ever came out of Germany. What is the reason for their efficiency? I will tell you what I think it is. I think the basis of this so-called efficiency is an honest day's work for an honest day's pay. And when we teach, through our engineering ability and our methods, that the prosperity of the whole country, whether it be capitalist or workman, depends on doing an honest day's work for an honest day's pay, all these theoretical questions such as the high cost of living will naturally disappear. I am not at all in favor of artificial methods to reduce the high cost of living. There is but one way to do it and that is, first, by economy and, secondly, by industry and efficiency. When we get this throughout our establishments, the high cost of living will, by the natural laws of industry, adjust itself to its proper place. Therefore, you, the engineers of the country who have done so much for the development of our country, it seems to me, must face a new problem. You had as a member of your society, Andrew Carnegie, one of the greatest captains of industry. He was one of the greatest developers of industry in this country, and yet he was not technical nor had he skill in the arts which he so greatly developed. But above all he had that quality of human engineering that enabled him to draw about him a body of men who gave their very best on all occasions. He always believed in approval and never in criticism and I have yet to find the man worth while in any station of life who does not always give his best efforts under the spirit of approval. The spirit of encouragement will always develop the best that is in any of us. In my establishment, I care little about the technical ability of a man if he has within him the sturdy qualities that makes men believe in his leadership, his honesty, and the pursuit and development of his work. It seems to me that you have this new branch before you in which a greater good can be done the country in this reconstructive development than by all the technical inventions and processes you can devise. We have won the greatest war, and we must not lose advantage of the lesson that we have learned by reason of the War: that lesson is, broadly, one that the President proclaimed as the lesson of democracy in the ordinary sense of the term -that all men are men for what they are."

Captain Hunt, who presided at the banquet, is the dean of the Chicago engineers and his reputation as a toast-master at Institute meetings is built upon an experience over a great many years reaching from the Klondike to the Tropics. Although in his 'eighties, his eloquence, grace, and humor have in no sense waned and the Chicago section was indeed fortunate in having his good services on this occasion.

Mineral Production of United States in 1918

The Department of the Interior has just issued a preliminary report on the mineral production of the United States in 1918 for the purpose of making public as soon as possible the statistics collected by the U. S. Geological Survey for that year. The statistics given for most commodities are final; those for a few are only estimates based on incomplete returns; but on the whole the report gives a fairly complete record of the mineral output of the country during the year. The total value of the minerals produced was about $5,526,000,000, more than half a billion dollars in excess of the value recorded for 1917, but the total quantity produced was less. The output of fuels was greater than in 1917, though somewhat less anthracite coal was marketed. The increase in the quantity of coal marketed was about 5%, but the increase in value, due to higher prices, was more than 17%. It is significant that though the increase in the quantity of petroleum marketed was only a little more than 4% the increase in value was over 32%.

The value of the metals produced was about 3% greater in 1918 than in 1917. The figures show that less iron ore and steel were produced, but here again values were higher. A little more pig-iron was made, though the quantity shipped was less. Copper and zinc not only in themselves but as the components of brass are perhaps next in importance to iron in the world's industry today, and in 1918 they stood high on the list of war metals. A little more copper but less zinc was produced, and the values of both were lower, that of zinc falling about 25%. The output of the war metals manganese and chromite, used in hardening steel, was greater than in any preceding year. Chromite increased 88% in quantity and 275% in value over 1917, and the increases in manganese ore were 136 and 100%, respectively. Less gold and silver were mined than for many years. Though the price of silver rose from 81c. per ounce in 1917 nearly to 97c. in 1918, the increase was not enough to cover the increased cost of mining. The output of building material—clay products, building stone, cement, lime, gypsum—showed a great decline. The domestic production of potash in 1918 was 54,000 tons, an increase of 68% over the output in 1917.

A MOLYBDENITE-BEARING quartz vein on Healy river, Alaska, which has been traced for the length of three claims, is the subject of a note by Theodore Chapin in Bulletin 692-F of the U. S. Geological Survey.

The Federal Taxation of Mines—I

Development of the Law as it Affects the Mine-Owner

By L. C. GRATON

*The fundamental object of taxation is not to impose a burden or a penalty on the taxpayer; rather the opposite; to secure the funds by means of which the Government may be enabled to extend to the taxpayer those benefits which he could not so well, if at all, secure for himself. Consequently, any program of taxation should be administered with the utmost sympathy and consideration, and with the least possible disturbance of the taxpayer's normal activities.

Until recently the Internal Revenue Bureau has been a relatively subordinate branch of the Government, and has had little attention from the average citizen. Since the passage of the income-tax amendment in 1913, however, and particularly since the rise of needs for enormous war-funds, the Revenue Bureau has become "an arm of the Government reaching out to every citizen and establishing a direct fiscal relationship with every business enterprise in the United States."

As all are aware, the revenue laws in so far as they specifically touch on the matters which relate to the mining industry, are nearly always brief and frequently not clear. These, like all other portions of the revenue laws, are made subject, for their interpretation and application, to regulations established by the Commissioner of Internal Revenue. It is most illuminating to observe how, as the importance and responsibility of the Commissioner's duties in this respect have expanded with the increasing magnitude of the taxes, the regulations with regard to the mining provisions of the law have with successive years reflected a greater and greater approach toward that fairness and equity which alone can be satisfactory and can lead to decisions that will hold. I beg of you to believe that every earnest effort is being made to eradicate and abandon all those things which have caused confusion, exasperation, or alarm to the honest and well-intentioned taxpayer. This message from the inside is a foremost object of my paper. It is, moreover, a necessary preliminary to the successful attainment of the second object, which is the securing of your co-operation and your help in solving a job that is as much yours as the Government's and that is no more to its advantage than to yours to have solved correctly. For notwithstanding every reasonable effort the Government may make, the job that confronts us is so big and difficult, has so many ramifications, that I believe the Government cannot master it single-handed, but must look to the specialized groups of taxpayers—in the case of mines, to the mine-owners, mining engineers, and geologists—for the advice and help with which to put the deal through. The Government is in a frame of mind to trust you as reputable engineers, to trust not only your technical talents, but to trust also your motives and integrity; and you are invited and indeed urged to contribute, for the sake of the general welfare of the industry, such help as you can. In what follows, I shall try to indicate, in outline, some of the principal problems involved, though most of you no doubt have by necessity become familiar with them through your professional connections.

The Federal taxes on incomes and excess profits are heavy. In 1917, the value of the mineral production of the United States was a little over $5,000,000,000. The total of Federal taxes for that year on the mineral-producing companies amounts to about $207,000,000, and the total for the comprehensive group of mineral and metal industries to about $766,000,000, which figures represent respectively 9.5% and 35.1% of the total paid by all corporations. For 1918 the taxes are still greater, but no compilations are yet available. Taxes at a high rate are to continue indefinitely. The subject is clearly of grave import to the mining industry.

In view of the peculiar conditions that attach to the tax program as applied to mines and other wasting industries, like oil, gas, and timber, the Commissioner has resorted to professional advice and assistance by manning a sub-division of Natural Resources with competent engineers, brought in from the several industries, into whose hands he has placed the technical questions involved.

The problems of mine taxation must necessarily be approached from a clear understanding of mining economics, of which the prominent and distinctive features are the hazard and the exhaustible character of the assets. Closely related to the latter feature is the necessity of maintaining efficient mining organizations indefinitely instead of limiting their existence to the life of the particular mine now being worked.

The principal questions to be settled revolve about the matter of mine valuation, but they are complicated by the fact that most of the values must be established as of a date several years ago. Among a variety of methods that might be employed, the one direct, professional, and established method is that which capitalizes income by determining the present value of total expected earnings. For the general application of this present-value method, there must be established a set of factors intended to adjust it to those examples which afford fewer data than the amount it requires ideally. Investigations must be conducted [illegible] less detail and thoroughness into a

*Abstract from paper presented before the Chicago meeting of the A. I. M. & M. E.

variety of subjects which enter into the application of the method, such as relation of interest-rates to hazard, ratio of proved to prospective ore in various types of deposits, effect of change in grade of ore and in rate of output, estimate of future selling-price of product, what constitutes discovery of a mine, and methods of depletion and depreciation. In the determination of all these matters a close touch with the industry will be maintained, with the sole idea of establishing principles that will be so sensible and sound that they may apply not only to the final settlement of taxes for the years now under review but may govern likewise through subsequent years so long as present or similar revenue laws prevail.

The applications and relations of capital to the mining industry involve different principles and are on a different basis from those in other forms of enterprise or investment. Two essential factors serve to distinguish the economics of mining from the economics of other industries: first, the much greater risk generally involved, and second, the fact that the life of the enterprise is fixed by conditions over which those engaged in it have but little control. In mining the raw material represents the chief investment and the raw material is the ore. Over that no man has control, and ordinarily, no one may know what or how much there is of it until he spends much good money to find out. If one company's operations demonstrate that, in a given tract of ground, Nature is not sufficiently generous to give man a profit, it would be a difficult matter to persuade anyone else to purchase the property. In such an instance every additional dollar spent by the company in development makes the situation worse and actually reduces the value of the property by eliminating the possibility that a better state of affairs may be disclosed.

Nor are the risks peculiar to mining limited to the question as to whether or not a given piece of ground will be found productive and worthy of the establishment upon it of an active operating mine, or whether the mine so established will continue to find profitable ore. The history of mining is filled with examples of important and temporarily profitable mines which gradually or suddenly came to grief in consequence of some of the accidents that constitute the other special hazards that peculiarly attach to the mining business. Witness the Alaska Treadwell. Mines at Butte, at Jerome, for example, have been on fire for years. Many a mine with good ore still in it had to be abandoned because water at last gained the upper hand. Every mine faces one or another of such catastrophes. In some respects, the greater the mine, the greater the menace. Clearly enough the abnormally high risk in mining must be offset by abnormally high returns. Clearly enough, the greater the hazard, the greater the portion of gross profit required to balance it.

It has also long been recognized by economists that mining is an industry of wasting assets and that the apparent income for a given year's operations is not true profit but part profit and part return of capital. The miner who sells his metal or his coal is selling not only his product, he is selling at the same time a part of his mine. The price he receives per pound or per ton must cover both. It is to be hoped that the general attention to this subject which the present heavy tax burdens are going to force will greatly clarify the general understanding of the subject. In emphasizing the idea of wasting assets, Finlay has stated that a mine is exactly like an account in a bank whose business is to be wound up by a receiver. Hoover and others have implied, likewise, that the business of a mining company is to work out its mine as rapidly as it reasonably can.

Even more fundamental, however, than the conceptions which underlie these statements and in a sense contradictory to them, is a principle which is becoming more obvious and important each year, namely, that the business of a mining company should be the mining business, in just the same sense that the business of a railroad company is the railroad business. What I mean is this: the companies which are producing the largest part of the country's output of most of the metals have made enormous outlays in time, effort, intelligence, and money to build up organizations of great size and remarkable efficiency, which cover all steps from the ore in the ground to the finished metal. In large measure, it is because of the perfection and the efficiency of organizations like these, some of them great, others on the way to become great, that the world is buying its metal supplies at prices not greater than those which now prevail. Probably in even larger measure is the country's dominance in mineral production due as much to these highly perfected organizations as it is to the natural mineral wealth of the nation. To assume or to require that each of these great organizations must be torn down and thrown away when the particular lot of raw material, namely, the mine on which that particular company is operating, happens to be used up, would be not only rank folly, but would constitute an economic waste as direct and as deeply injurious to the public welfare as waste in the mining of coal, in the efficient utilization of water-power, or any of the other national extravagances or deficiencies which we are striving to overcome and eradicate. Evidences are constantly multiplying that large mining corporations realize that they must regard themselves as continuing organizations. They are providing or attempting to provide themselves with new supplies of raw material, that is, new mines, as soon as or before their present supplies give out. Since such a policy is sound and in accordance with public good, it must be both permitted and encouraged. In short, the mining company really ought to set by a fund for replacement rather than a fund merely for return of original capital, and this replacement fund ought to include an insurance factor to cover the extra risk involved in assuring to the company its new supply of raw material.

It is unnecessary to emphasize the importance of the place held by the mining industry of this country. In 1917, the latest year for which data are available, the value of the mineral production of the United States, as computed by the Geological Survey, amounted to $5,011,000,000. This represents probably a larger portion of the estimated gross national income of $68,000,000,000 for

that year than was contributed by any other single industry save the railroads. Indeed the only reason why the income of the railroads somewhat exceeded that of the mineral industry is because, as the Director of the U. S. Geological Survey has recently pointed out, the mines and smelters, oil-wells and refineries, quarries and cement-mills furnish to the railroads more than 4,000,000 tons of freight per day, or nearly twice as much as all other freight combined.

The 1917 mineral output is divided in round numbers as follows:

Principal metals	[illegible]	41.1
Coal	[illegible]	30.4
Oil and gas	703,000,000	14.0
Miscellaneous	726,000,000	14.5
Total	$5,011,000,000	100.0

Thus metal and coal mining accounts for 71.5% of the total mineral production of the country.

As would be expected from the gross income of the mineral industry, the portion of the total Federal taxes which this composite industry bears is very high. The taxes paid by the mineral industries in 1916 and 1917 amounted to $31,000,000 and $373,000,000, respectively.

Although the Federal tax laws as they apply to mines have not taken into account in any direct way the excessive risks involved in mining, they have lately given some recognition to the second difference that characterizes mining, namely, that its assets are exhaustible. This recognition comes under the head now designated in the laws as 'depletion'. Although various taxes were levied by the Federal government on mining companies and on mineral production during the Civil War, the first Federal tax in recent years to affect the mining industry was the corporation excise tax of 1909. It levied a tax of 1% on the net income above $5000. This law provided, as a deduction from gross income to arrive at taxable net income, "a reasonable allowance for depreciation of property, if any," but did not specifically refer to depletion of mineral deposits. Many mining companies, however, in making their returns under this law made claims for depletion. The Internal Revenue Bureau allowed these claims until 1913, when the Supreme Court decreed that 'depreciation' as used in the law does not apply to exhaustion of mineral deposits and that therefore no deduction occasioned by this exhaustion could be allowed.

In 1913, however, after a special constitutional amendment had validated the principle of taxing incomes, the 1909 Excise Act was superseded by a new law. This levied a 1% tax on net income, which should be computed after deducting among other things, "a reasonable allowance for the exhaustion, wear and tear of property, arising out of its use or employment in the business, not to exceed in the case of mines, 5% of the gross value at the mine of the output for the year for which the computation is made." Thus the principles of both depreciation of physical property and depletion of mineral deposits were put upon a firm legal basis.

The 1913 revenue law was superseded by one in 1916 which levied 2% on the net income of corporations and prescribed [illegible] as follows: "A reasonable allowance for the exhaustion, wear and tear of property arising out of its use or employment in the business or trade." In the matter of depletion, oil and gas wells were for the first time specifically distinguished from mines. The oil and gas wells were granted "a reasonable allowance for actual deduction in flow and production," while to mines was given "a reasonable allowance for depletion thereof not to exceed the market value in the mine of the product thereof which has been mined and sold during the year for which the return and computation are made."

The 1917 law applied a 6% tax on corporation incomes with exactly the same terms as to depreciation and depletion as did the 1916 law, but to meet the heavy additional expenses of war there was also levied an excess-profit tax of from 20 to 60% on portions of the net income as determined in relation to invested capital. There was also inserted a provision that an additional 10 to 15% be levied on that portion of income undistributed six months after the end of the year, except such parts of that surplus as are actually invested and employed in the business or are retained for employment in the reasonable requirements of the business or are invested in Liberty bonds.

Finally, the law of 1918 levies a 12% tax on corporation incomes for the year 1918 and 10% for subsequent years. In this law, depreciation is covered by "a reasonable allowance for the exhaustion, wear and tear of property used in the trade or business, including a reasonable allowance for obsolescence," while with respect to depletion, the law provides: "In the case of mines, oil and gas wells, other natural deposits, and timber, a reasonable allowance for depletion and for depreciation of improvements, according to the peculiar conditions in each case, based upon cost including cost of development not otherwise deducted: Provided, that in the case of such properties acquired prior to March 1, 1913, the fair market-value of the property (or the taxpayer's interest therein) on that date shall be taken in lieu of cost up to that date: Provided further, that in the case of mines, oil and gas wells, discovered by the taxpayer, on or after March 1, 1913, and not acquired as the result of purchase of a proven tract or lease, where the fair market-value of the property is materially disproportionate to the cost, the depletion allowance shall be based upon the fair market-value of the property at the date of the discovery, or within 30 days thereafter."

There was also imposed a war-profit and excess-profit tax which provides for the collection on various fractions of the income of amounts that range in 1918 up to as much as 80% of certain portions, and up to 40% for subsequent years.

Summed up, these several laws have provided for taxation of income at steadily increasing rates from 1% up to 12% for 1918. They have levied a heavy excess-profit tax in 1917 and still heavier in 1918. Both income and excess-profit taxes are continued indefinitely for years subsequent to 1918, though at rates somewhat lower than

for 1918. Allowance for depreciation of physical property has been provided for in the income tax of each of these years and has been extended to cover obsolescence beginning with 1918. Depletion has been treated in a different way with nearly every law. Allowances or depletion, specifically unauthorized by the first law, were granted until pronounced illegal by the Supreme Court. Then in 1913, a 5% allowance on the gross value of the year's product at the mine, in 1916 and 1917 an allowance not exceeding the market-value of the year's product in the mine, and in 1918, a reasonable allowance for depletion according to the peculiar conditions in each case, based generally upon market-value as of March 1, 1913, but allowing for re-valuation in case actual discovery subsequent to that date shall have materially increased the value.

On the whole, therefore, increasing taxes have been accompanied by increasing reasonableness and liberality as to tax-free deductions for depreciation and depletion, although, of course, the increase in the allowances has been of no such magnitude as the great increase in taxes.

It is clear that, whether the existing laws be reasonable or senseless, the activities of the Revenue Bureau are necessarily confined to the limitations that the laws impose. If the laws are found to be bad, it is to be hoped that their shortcomings may be so clearly pointed out that Congress will see fit to remedy them for the future; but unless relief, if found to be needed, shall subsequently be given and made retroactive, which seems unlikely, the procedure which must be followed for the present is already outlined in the laws. In the matter of mine taxation, we cannot be materially concerned with policies for taxing idle mineral lands or unprofitable mines, since neither class earns income. All we can do in the present connection is to take the laws as they are and apply them fairly.

The regulations which according to the laws are to be promulgated by the Commissioner of Internal Revenue for the interpretation and application of the tax laws have been written for each of the laws through 1918. But in their case, opportunity for revision and improvements is not excluded. For the desire and intention of the present Commissioner are, while adhering to the limits set by the law, to administer the tax program in the light of facts and equity. It is for the purpose of assisting in the formulation of rules and the making of decisions relating to minerals and related products that there has been gathered together a group of engineers to constitute the recently established Sub-division of Natural Resources of the Income Tax Unit. Obviously enough the main job of this Sub-division is one of valuation. The metal and coal mining problems have been but slightly touched as yet, in so far as concerns settlement of those features that depend upon valuation, for the determination of the taxes in 1917 and for the review of the taxes or 1916. The two fundamental objects to be achieved are, first, impartial balance as between different taxpayers in a given industry, and as between one industry and another, and second, finality of the decisions. If proper balance is attained, finality will be assured. If, on the other hand, the decisions are not sensible and just, there is likely to be no end of revision and unsettling of results, so, after all, balance is the prime requisite. The Revenue Bureau will endeavor to act in the joint capacity of trustee for the taxpayer and for the Government and will seek to harmonize the interest of each.

The latest law clearly recognizes the wasting industries. The mining industry is thus among the few to which distinctive treatment of any kind is applied. However, not all the consequences of the exhaustible character of mines are provided for in the law, as, for example, the establishment of a replacement fund. Neither is special consideration afforded to cover the extra hazards involved in mining. For example, in the average business, the largest part of the investment is protected by insurance, and the expense of that insurance is properly charged into working costs. The largest part of the mining company's investment is represented by ore in the ground; the great and varied risks that attend the extraction of that ore cannot be insured against. The only insurance protection is afforded by the increased return to the investor. Yet high rate of interest results in the computation of low valuation, hence low depletion allowance, and consequently, high tax. And then instead of deducting from income his heavy insurance expenses, much heavier than in most other industries, the miner pays tax on it as if it were true profit.

Perhaps the requirement of next importance is that every effort be made to avoid setting up regulations and procedures that will furnish strong incentive to the mining company, in the hope of lessening its tax burden, to adopt practices or pursue policies contrary or foreign to the dictates of good sense and the well-founded customs of the industry. Such a policy would mean bad tax-collecting, bad mining, and therefore, in reality, bad morals. I do not refer to deliberate evasions of a culpable kind, but to acts which, though legitimate in the sense of not being illegal, are nevertheless wrong because artificial, indirect, and probably subversive of the public good.

As an example, there comes to mind the case of many ore deposits in limestone, where, because of the irregular distribution of the orebodies and the heavy character of the ground when the altered rock is exposed to the air, it is customary to carry development work not far ahead of current extraction. In the matter of valuation on the basis of exposed or proved ore such mines are clearly at a disadvantage with extensively developed mines like the 'porphyry' coppers. If, to overcome this disadvantage, one of these limestone mines should greatly expand its underground development and should thereby discover a proportionate amount of new ore, it might gain a higher valuation and thus, through greater depletion deduction, pay a lower tax. But the money thus saved to it (and lost to the Government) would be partly offset, perhaps eventually more than offset, by long-time interest charges on the expense of the idle development and by the likelihood that when finally needed for extraction purposes, the workings would require heavy repairs or be useless.

ALASKA

The following exchange of statements between the Alaska Labor Union and the Alaska Juneau Gold Mining Co. are self-explanatory. They appeared as advertisements in the Alaska 'Daily Empire' of September 16. The strike to which they refer came to an end on September 30, the strikers returning to work on the terms of the company.

CHARGES AND DEMANDS

ALASKA LABOR UNION
Local No. 4
Juneau, Alaska, Sept. 15, 1919.

To the Office of the Alaska Juneau Gold Mining Co.
Juneau, Alaska.

Dear Sirs:

We, the workers of the Alaska Juneau mine, find that the present wages paid at the said mine are not sufficient to meet the present high cost of living.

The wages paid at this mine are pre-war wages, and since necessities of life have increased from one to three hundred per cent., the wages at the mine remain the same.

Wages in all mining camps throughout the country, with the exception of Juneau, have increased wages to meet the high cost of living.

We, the workers of the Alaska Juneau mine are organized for the following demands:

1. An increase in wages, of one dollar per day for all men in the mine working for the company.

2. An increase in wages, of one dollar per day for all men working for contractors or sub-contractors, the company to back the contractors for this increase.

3. No men to be kept underground for longer than eight hours in one day.

4. The board and room at the company's boarding house to remain the same, $32.00 per month.

5. That the company put no worker on the "BLACK LIST" for making these demands, and after settlement all workers to be reinstated.

The above are the demands of the workers of the Alaska Juneau mine, and the undersigned committee have been appointed to negotiate settlement with the company.

JAMES FOGARTY,
G. WAGNER,
WILLIAM HILL,
Committee of the Workers.

REPLY

The Alaska Juneau Co. cannot pay an increase of $1.00 per day as demanded because it is now operating at a loss.

The Alaska Juneau average pre-war wage was $3.51 per day.

The Alaska Juneau average wage paid today is $5.05, making an increase of $1.54 per day.

While this raise in wages has been made voluntarily, no raise whatever has been made in the charge of board and lodging, which has remained at $32.00 per month throughout, although at a loss now of forty cents per day per man to the company.

The total cost of a man to the Alaska Juneau Co. before the war, for wages, supplies, power, etc., consumed, averaged $5.00 per day.

This total cost now averages $11.00 per man per day, or for the 240 men now employed, a difference of $43,000.00 per month, of increased cost to the Alaska Juneau Co. as against a pre-war cost for the same number of men.

It is well known that because of the high prices brought on by war conditions, that gold has lost one-half its purchasing power.

The Alaska Juneau enterprise is therefore not of a profiteering nature and does not lend itself as a hotbed for propagating Bolshevism.

Men working underground in the Alaska Juneau mine are earning more money than men working in the Kennecott Copper Mines are earning today after having had their wages raised $1.00 per day last month.

The Alaska Juneau is a steady, continuous operation employing a continually increasing number of men, with an increasing average wage throughout the war period.

On the other hand, when the price of copper went down after the armistice, wages in the copper camps were not only reduced, but one-half of all the crews in the copper camps were arbitrarily discharged.

That is, in the profiteering business of copper mining, the public and the employee are made to stand the loss when the price of the product goes down; while in the case of the Alaska Juneau, the company's stockholders have been suffering a monthly loss throughout the war period, which loss till continues.

This monthly loss will unfortunately continue, until the present mill alterations and enlargements are completed.

It is well known that because of the experimental features in the company's new milling plant, it did not attain half of its promised capacity and that at an oper-

ating cost per ton three times larger than it should have been.

The construction work now going on is to correct these defects so as to place the property upon a profitable operating basis. Fifty more men are now needed to hurry this work along; and when completed, an industry will have been established that will give employment regularly to at least 600 men.

It should be apparent that it is not fair to compare the wages paid in a gold mining camp with wages paid in a profiteering copper mining camp; and if a comparison is made with other gold mining camps, it will be found that the Juneau district is paying the highest going wages.

The Juneau mines voluntarily raised wages over a year ago, while in the Grass Valley gold mining district of California the men struck last July for an increase of fifty cents per day. This strike was compromised by the men agreeing to accept an increase of 10%, but such increase to be payable to only such men as were continuously on the payroll of three months, unless off on leave or on account of sickness.

Even with this raise of last month in the Grass Valley gold mining district of California, the wages paid in the Juneau district are much higher.

A number of Alaska Juneau shareholders have sufficient confidence in the property to loan the company each month the funds necessary to pay all its bills in cash; but there is a general feeling amongst financiers that gold mining is in for a long period of depression and consequently it is becoming more and more difficult to raise money for gold mining purposes. Therefore, any tolerance or encouragement of any uncalled for and unfair agitation that would make the company's operations more costly, may result in an embarrassment that cannot be overcome.

The Alaska Juneau Co., of course, has to pay going wages in order to secure good men. It has been doing the very best it can in this matter and cannot accede to demands that on their face are borrowed from shipyard and copper conditions that are not at all comparable with conditions in the gold mines of the Juneau district.

ALASKA JUNEAU GOLD MINING CO.

REPLY TO THE ALASKA JUNEAU GOLD MINING COMPANY

The workers of the Alaska Juneau Mine believe that the company can pay the increase of $1.00 per day and have voted unanimously to stay out until the demands presented to the company are met. We also believe the Alaska Juneau mine is on a paying basis, as no mine would operate at a loss merely to keep the mine open.

The Alaska Juneau Gold Mining Co. are not paying the $1.54 per day increase on pre-war wages as they state, for if that sum was added to the pre-war wage it would be exactly what the miners are striking for now.

In getting this average increase, the company has taken in contractors, some of them making as high as $15 to $20 per day.

We agree with the Alaska Juneau Gold Mining Co. that gold has only one half its former purchasing power.

This is true, for we find the same trouble with it ourselves. How about other minerals in the Alaska Juneau Mine, such as zinc, galena, iron, etc., which have gone skyward and according to quotations, more so than copper?

Again, the Company states that it is not fair to compare the wages of a gold mining camp with that of a copper mining camp.

What is the difference between them? There is the same work in both. The Company also states that Juneau pays the highest wages in the country.

We wish the Company to mention one camp where the wages are lower than Juneau, and if an examination is made it will be found that Juneau is in arrears of from one to two dollars per day.

Company officials returning from a trip of inspection of other mines in Alaska about three weeks ago, stated that the Alaska Juneau mine was the best in Alaska; if so, our demands can be met.

We also wish to inform the Company that these demands are made on fair grounds, and have no Bolshevism in them as the Company intimated.

ALASKA LABOR UNION NO. 4.
STRIKE COMMITTEE,
JAMES FOGARTY,
G. WAGNER,
WILLIAM HILL.

ARIZONA

NIGHT HAWK OBTAINING ENCOURAGING RESULTS.—GENERAL NEWS OF THE STATE.

BISBEE.—An important discovery has been made on the Night Hawk lease, near Don Luis in the south-eastern corner of the Warren district, which adds largely to the known ore-reserve of the property. After driving through 65 ft. of 8% ore and then through a fault about 20 ft., a round of holes shot on the night of September 26 resulted in opening a body of high-grade ore. The deposit is said to have the same characteristics as the orebody opened up in the property off a winze on the 450-ft. level. On the latter level there was developed recently approximately 42 ft. of ore averaging 8% with streaks of high-grade running through it. The ore developed in the Night Hawk is sufficient to outlast the duration of the lease, which has approximately four and a half years to run. No more prospecting is considered necessary, although it is the general belief that depth would prove enrichment of the orebody. Credit for the new discovery is given by the company to James McKenna, foreman in charge of the work, who has carried out his own ideas in the development work. The Campbell shaft of the Calumet & Arizona company now is down 170 ft. from the surface. Work was resumed at this shaft in July this year, after having been abandoned since August 1917. The total depth of the shaft is to be 2200 ft. To investigate the possibility on the porphyry zone, represented by Sacramento hill of the Phelps Dodge corporation, the Calumet & Arizona has begun sinking a series

of churn-drill holes on the Campbell group near the Sacramento line. The first hole was started late in September. Two or three more will be put down before the test is considered complete.

HILLTOP.—Charles Berkey, professor of geology at Columbia University, assisted by Louis D. Huntoon, formerly professor of mining at Yale University, has been working for several weeks in this vicinity upon a geological survey of the Hilltop Metals Mining Co. and the Hilltop Extension Mining Co., the former owned by Chicago capitalists and the latter by New York interests. The survey was abandoned temporarily late in September, owing to Dr. Berkey being recalled to New York by the duties of his professorship, but will be resumed on October 25. At a recent meeting of stockholders of the Hilltop Metals Mining Co., held at Douglas, plans were formulated for building a railroad from the mine to Rodeo, New Mexico, there to join the El Paso & Southwestern. Tentative plans for building a smelter and mill also were discussed. The Hilltop has an excellent plant, particularly in the power division, which is furnished by a 300-hp. Diesel engine. Plans are said to be under contemplation whereby the Hilltop and the Hilltop Extension may co-operate more closely in development of their holdings. The Ajax property, 4 miles south of Hilltop, now is working steadily upon development. Completion of the shaft to the 200-ft. level was followed by cutting a station and driving in two directions to open orebodies traced upon the surface. The underground showing is said to be excellent.

COURTLAND.—The Great Western Copper Co. is shipping a carload of sulphide ore daily to the C & A smelter at Douglas. About 30 men are employed, in addition to several lessees working on its property. On the Leadville No. 2, O. T. Smith is working 20 men under a lease. He recently opened up an orebody said to average 6% copper. Peter Mouse, another lessee on the Leadville No. 2, is shipping an average of six carloads of 6% ore monthly.

PEARCE.—The Commonwealth Development Co., under direction of A. Y. Smith, is working the old tailing dump. About 250 tons of low-grade ore per week is being taken from the Commonwealth mine and run through the mill. Several lessees also are taking out silver ore which runs high in silica and therefore is received at a premium by the smelters because of its value as converter lining.

MIDDLEMARCH.—In order to resume operations it will be necessary for the Middlemarch Copper Co. to tear down the Diesel engine, which furnished motive power for its mill, to remove carborundum from the bearings. Discovery of the dust in the bearings was made by company officials, following a labor strike on the property. The discovery was made before the engine was turned over, thus averting what would have been very costly damage. The pumps also were closed down during the strike and in order to resume underground operations it will be necessary to unwater the mine, which was flooded during the shut-down. This will require several weeks.

MASCOT.—The Mascot Copper Co. has been working a test mill for more than a year and now has enlarged the plant by installing four Wilfley tables to take care of the low-grade. Test runs made recently showed capacity for 24 hours to be approximately 150 tons.

GOLD PRINCE.—The Gold Prince Mining Co. is operating the old Bain mine, a gold property. A clean-up of between $3000 and $4000 is being made every two weeks. About 30 men are employed in the mine. G. Wilty is in charge.

PATAGONIA.—The World's Fair mine has resumed operations after having been closed down three months because of litigation. The Hardshell is sinking a three-compartment shaft which is now down about 400 ft. Tom Frazier is contractor. The Duquesne, under lease to Panick and Curry, is shipping about 400 tons of ore per month.

CALIFORNIA

GRASS VALLEY, SIERRA COUNTY, NEVADA CITY

GRASS VALLEY.—An effort is being made by C. A. Brockington, superintendent of the Grass Valley Con. Mines Co. owner of the once famous Allison Ranch mine, to bring the mine again into the dividend class. For a number of years past the mine has been re-opened at different times, but after a short period of operation the bonds have always been allowed to lapse, although the rich streaks overlooked in former mining have yielded some good ore. The miners and lessees took the cream—a favorite and popular occupation in this district among the underground men. It has been a struggle for years with the various managements to restore the mine to its old time productiveness. The work in hand at present is mainly prospecting. Two drifts are being driven, one east and one west on a lower level. The one east is being driven into unexplored ground from which veins outcrop, although little is known of their surface tenor. That drift is now in nearly 700 ft. The west drift is being driven toward the Omaha and Hartery veins, both of which yielded bonanza ore in the upper levels. To cut these veins, of which the Hartery will be the first, will require a drift about 1100 ft. long. The former yield warrants the management in exploring these veins at depth in the hope of finding new shoots. A few 'tributers' are at work on low-grade ore of uncertain tenor, and some company ore is being mined. The mill, however, is running but one shift a day. The mine has been cleaned out of almost all its developed ore; its future depends entirely upon the result of the present prospecting.

SIERRA COUNTY.—Some months ago Fred Searls, Jr., of Nevada City, secured an option on the idle Tightner mine at Alleghany on terms and conditions that have not been made public. Recently, at Grass Valley, the directors met and formally executed an agreement under which work must commence within thirty days and proceed along given lines of development. Preparations have already been made for beginning operations. The underground work consists of a long tunnel and two shafts of 400 ft. each. These will have to be pumped out before the search for ore can commence. Although the

mine was considered exhausted at the time of closing, the Tightner had produced over $1,500,000 within seven years, a fact that encourages the present search for new pockets. Lack of visible ore combined with war conditions compelled the closing. Under the transfer the old stockholders will receive a royalty and the option price will be paid over a period of years. With the bond the following properties are included: Tightner Placer, Eclipse, West Extension Eclipse, Aelene, Red Star, and Tightner claims; some 200 acres in all. Fred Searls, Jr. will be in charge. The surface plant consists of a 20-stamp-mill compressor, and accessory equipment, all electrically driven. The original mine was opened by H. S. Johnson and later sold to the Tightner Mining Co., the success of which caused the opening of a rich district. The district is still productive; although at present it is being operated at a disadvantage.

Smuggler Union Mining Co. mill construction is nearing completion and will soon be in condition to handle large tonnages. The shaft on the Black Bear is progressing, and shipments from the Black Bear will be resumed at an early date. The Liberty Bell Gold Mining Co. is leasing a block of Smuggler Union ground. Patents were applied for on the Happy Home Monarch and Moon Anchor lodes by Wichman and Olson. Driving along the vein on the Modena has opened up some good ore and shipment will be made at an early date. The Tomboy Gold Mines Co. has installed the third of a series of large ball-mills.

On the evening of September 10, a mysterious crime occurred at the portal of the Montana tunnel of the Tomboy, when four miners were killed while on their way to work on the night-shift. The men were shot down by two masked men, according to the report of witnesses,

THE INTEROCEAN MINE, BOULDER COUNTY, COLORADO

NEVADA CITY.—A recent transfer has been recorded from W. G. Motley and wife to Mrs. Lizzie H. Hoge, which includes the West Buckeye placer, Buckeye Extension, Bertha Extension, Cold Springs gravel, Buckeye, West Buckeye, and a part of the Willow Valley quartz claims, together with the hoisting, pumping, and milling plant. These properties are in a mineral-bearing district and are considered to be good prospects. The California Mining Co. is running a tunnel in the Cold Springs ground to reach a part of the Harmony ridge system. The tunnel has reached a length of over 800 ft. and is still in hard granite.

COLORADO

OPERATIONS IN THE TELLURIDE DISTRICT.—DETAILS OF THE CRIME AT THE TOMBOY.

TELLURIDE.—The shortage of labor has been relieved to some extent by the influx of a large number of laborers and miners recruited by labor rustlers during Fair week in Durango. Production is still very light. The

but no motive or clue as to the identity of the assassins has been discovered as yet. The victims were Eric Sund, Gus Danielson, Fred Smith, and Celeste Mattivi killed, and Joe Kochevr wounded. These men were members of contracting parties working on the 1000-ft. and 1150-ft. levels. The first information received of the trouble was when Kochevr staggered into the mine-office and reported the crime, stating that as he entered the tunnel with his companions they were fired upon by masked men, who aimed at their carbide lamps. Mattivi arrived later accompanied by Giacomozzi and Moletti, his partners, who were contracting on the 1000-ft. level, and, disregarding the warning of Kochevr, started toward the tunnel, when according to Giacomozzi and Moletti, two men at the portal of the tunnel opened fire, pursuing Mattivi to the dump and shooting him down at that point. A posse was formed of the sheriff and mine officials, who were on the ground within a short time. The bodies of Smith and Danielson were found at station 125, a room built off the drift for a lunch-room. Sund

was found mid way between the station and the pump, and Mattivi on the dump outside. All the men had been shot below the ear in addition to other wounds evidently to ensure death. A posse [illegible] all the possible trails and clues, but no direct evidence was secured. At the inquest held on September 16, Moletti, Giacomozzi, and Kochevar were held on suspicion, and charges will probably be preferred against them. The various theories advanced as a motive for the crime [illegible] by the facts. The theory that there was a battle among 'high-graders' is contradicted by the fact that there is no high-grade in this part of the mine. All the victims carried large sums of money, and valuables, but there was no robbery. There had been some feeling over the building of a fire in the stove at station 125, by the men working on 1150-ft. level, flooding the upper level with smoke and hindering the work of Mattivi, Moletti, and Giacomozzi, but the practice had been stopped. The general feeling over the crime is high, as it is a culmination of a series of crimes of like nature extending over the past few months, and there will be a determined effort to bring the criminals to justice. A reward totaling $2500 for information leading to the conviction of the guilty men has been subscribed by the following: Tomboy Gold Mines Co., Ltd., $1000; the Liberty Bell Gold Mining Co., $500; the Smuggler Union Mining Co., $500; and the City Council, $500.

MICHIGAN

LIFE INSURANCE POLICIES FOR CALUMET & HECLA EMPLOYEES.—METAL SITUATION UNCHANGED.

The announcement of the Calumet & Hecla management of a blanket life insurance policy for everybody in their employ has caused much comment in the district. It is generally believed that other mining corporations operating in the Michigan copper district will follow the lead of the Calumet & Hecla and make similar appropriations for the benefit of their employees. In fact, a number of the corporations have been considering such action for some months but have not as yet ripened their plans to a point where they are ready for announcement. Calumet & Hecla and subsidiary interests now employ half of the mine workers of the Michigan copper district.

There is no evidence of any unrest among the workers in the district. Although there have been labor difficulties in practically every other district in the world in the past year, the Michigan district has been free from trouble of any sort, a fact that has occasioned considerable favorable comment. In fact there has been nothing in the way of unrest shown here since the Moyer-Mahoney group was defeated in its efforts to force the Western Federation of Miners upon the district. That strike was concluded in 1914. It was a long-fought struggle, but it ended decisively and the decision was that the Lake Superior district could continue to operate without the Western Federation. The defeat of the Moyer followers was the beginning of the disintegration of that strong miner's union, for the collapse of the Federation in Butte followed shortly afterward.

[illegible] is nothing new in the metal situation so far as can be observed. There has been no increase in either output or metal shipments. It is conceivable that the negotiation of the 50 million Belgian loan in the United States will result in a stimulation of buying for foreign account, although the general feeling is that there can be no great benefits to the demand for Michigan copper, which is presently required to [illegible] needs, until the German business interests get into the market again.

The Mayflower-Old Colony shaft is now at a depth of 1520 ft., in trap. For 100 ft. the shaft has been alternating between trap and amygdaloid. Fine copper appears in the amygdaloid but not in the trap. First it was believed that the trap was the foot-wall of a known recognizable formation, but the extreme width and the continued breaking of the lode makes its identity uncertain. Mass Consolidated is making notable increase in shipments. Isle Royale continues to mine more ore than its mill can handle, the overflow going to the subsidiary on Torch lake. Last week 4000 tons went to the subsidiary mill, in addition to maintenance of daily normal tonnage of 2000 tons at its own 3-head mill. Ahmeek now is producing ore at the rate of 2600 tons daily and Osceola's combined tonnage is 2000, three quarters of which is coming from the Kearsarge. It is reported that Boston capital will finance Bear Lake exploration operations, where copper was found east of the sandstone. Victoria took out a 4-ton piece of mass copper last week and continues to encounter a lot of this material in the lower levels.

NEVADA

STRIKE SETTLED AT TONOPAH AND DIVIDE.—CURTIS CROESUS TO BUILD CONCENTRATOR.

TONOPAH.—The Tonopah and Divide millmen's union, a new organization in the Tonopah and Divide districts, has reached an agreement with the operators, settling the strike that had kept the mines and mills inactive since August 17. The organization was formed for the purpose of ending the strike. Eighty-four miners signed when the union was organized. A member of the mine operators' association estimated that not to exceed 250 miners were in both districts on the day the strike ended. No wage increase was granted, but the operators, at a meeting with the workers two days before the strike ended, practically agreed to make both districts closed for a local union and also agreed to guarantee a 15% reduction in the cost of living through a general store to be opened by them. When the new union acted all of the craft unions had called off the strike and it was the intention of the operators to resume work regardless of what action was taken by the union. When the strike ended, Governor Boyle, aiming at the I. W. W. element, said in a statement: "Craftsmen and mine and mill workers in all of the labor organizations here which profess American principles have officially voted to return to work. No other type of organization or mob has any legal or other standing in this State, nor will any such

aggregation be permitted to libel any town or district in Nevada by any form of published or spoken allegation that a strike originated by it is in force or that any workman is a scab."

EUREKA.—Eugene Davis, principal owner of the Eureka Croesus Mining Co., has purchased the Eureka and Palisade railroad for a price reported to have been $1,000,000, and it is planned to increase greatly the freight-carrying capacity of the road. Another locomotive recently was purchased and is in use hauling general freight and ore. The winze from the 400-ft. level of the Eureka Croesus is 275 ft. deep and ore assaying $200 per ton in lead and silver is being shipped from it. The vein is 40 ft. wide and the ore is being broken over a width of 20 ft. No driving has been done from the winze. George O. Bradley of San Francisco has been employed to develop a process for treating the ore, and it is reported that construction of a concentrator will be started early next year.

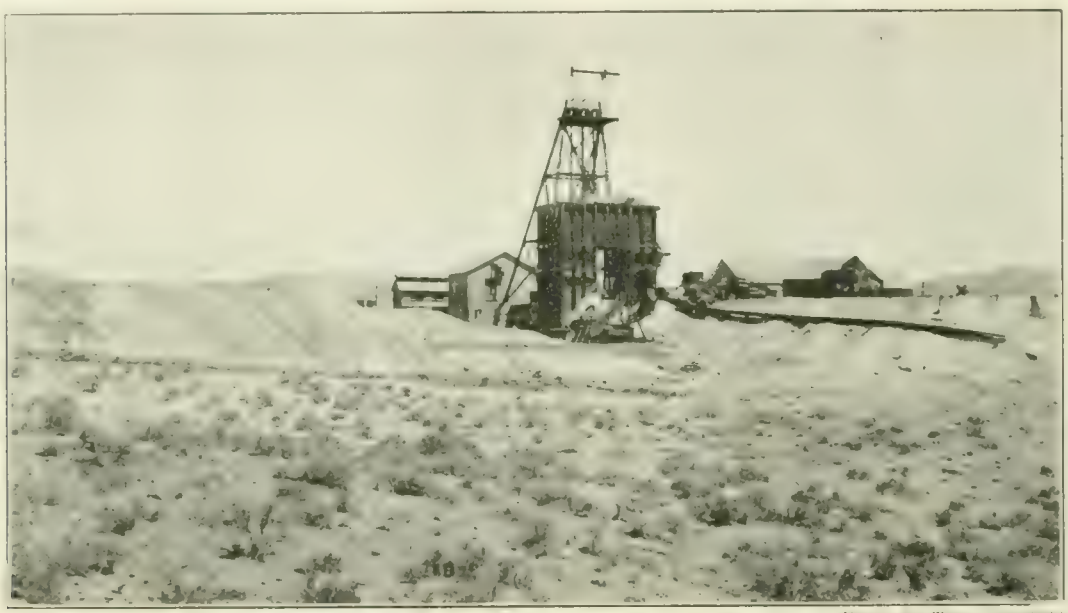


Photo by Tame, Goldfield

THE LAGUNA SHAFT, GOLDFIELD, NEVADA

TULE CANYON.—The Tule Canyon Placer Association, after spending $6000 in developing under option a group of placer claims at the upper end of the canyon, has discontinued work owing to inability to place the operations on a paying basis. A. I. D'Arcy, organizer of the association, has been in New York practically since work was started in connection with his duties as general manager for the Goldfield Development Co., and the failure of the placer venture is said to have been due largely to his being unable to give it his personal attention. According to members of the association, work may be resumed on return of Mr. D'Arcy if an extension of the option can be secured. The Goldfield-Tule Canyon Placer Mining Co., operating below the association, will reduce the working force to a minimum and continue on a small scale. This is caused by the unusually small flow of water in the canyon at this season and inability to raise funds in southern Nevada during the Tonopah-Divide strike. The Goldfield-Tule Canyon has spent over $5000, but a large amount of work has been done in driving and cross-cutting and in improvements to the surface plant.

GOLDFIELD.—J. K. Turner, consulting engineer of Goldfield, has made a report on the claims of the Merrill Silver Lead Co., 10 miles south of Goldfield. The company was incorporated by several Goldfield mining engineers, including G. H. Duell, formerly chief engineer for the Goldfield Consolidated and one of the engineers who demonstrated the practicability of the 'glory-holing' of the Consolidated mines by the Development company. The Merrill Silver Lead owns 8 claims from which small quantities of ore were shipped by a former owner. The principal vein has an average width of 30 ft. and extends a distance of 1800 ft. through three claims. Little work has been done on the claims. A 20-ft. shaft sunk at the intersection of the main vein and a cross vein has exposed 4 ft. of ore assaying a trace in gold, 1.40 oz. silver, and 7.40% lead. A sample taken from a 1-ft. width at this point gave an assay return of $27.70 per ton. The silver is in bromide and chloride form, principally the latter, making the ore slightly refractory. The cross-cut from the 100-ft. winze from the 320-ft. level of the Cracker Jack has been driven 55 ft. toward the vein, which it is estimated should be entered at 80 ft. from the shaft, later surveys having proved the dip to be less than was at first estimated. The gross production of the Florence from July 11, the date on which it was taken over by the new management, to October 2 was $150,505. Of this sum $120,695 worth of ore has been settled for by the smelters, and 5 lots, valued at $29,810, have not been settled for. The production was made entirely by lessees. The last three cars shipped by the Florence Divide lease were valued at $60, $112, and $246 per ton. The Delcic lease shipped a carload assaying $50 per ton on October 1. Ten lessees are working in the mine. The west cross-cut being driven by the Florence company has

been advanced 200 ft. into the [illegible] and toward the Columbia mountain fault.

OREGON

PLATINUM IN PLACER MINES—A CONSIDERABLE OCCURRENCE IN THE HIGHLAND QUARTZ MINE.

JACKSON AND JOSEPHINE COUNTIES.—But little attention was paid to the production of platinum in southern Oregon until the War. With the interruption of the normal importation from the Ural mountains, the Government made a special effort to discover and develop the deposits in Jackson and Josephine counties. To this end

THE OLD CHANNEL PLACER MINE, JOSEPHINE COUNTY, OREGON

L. M. Prindle and H. G. Ferguson, geologists of the U. S. Geological Survey, early in the War spent over three months in an inspection of the region, including practically every hydraulic placer-mining district in southern Oregon and northern California. In nearly every district visited by these geologists they found that, prior to their coming, practically no attention had been paid to the recovery of platinum by the hydraulic miners. The miners had often discarded it without recognition, or, after keeping it some time as a curiosity, threw it away when a ready local market was not available. The geologists, however, found that platinum occurred in small amounts in almost all the placer diggings, and started interested investigations on the amount that it was possible to recover.

Platinum, like chrome in this region, is closely associated with serpentine. It occurs as an alloy of platinum, iridium, and osmium, as in the Ural mountains. Although it is believed that the source of the gold placers, like those of California, was in the serpentine and oli-

considering [illegible] the Sierra Nevada and Siberia [illegible] the source of the platinum has not been traced to lode deposits containing the metal in the native form, [illegible] prompt by operations [illegible] lode deposits [illegible] discovered. A conglomerate of the platinum and in some specimens a black or brownish coating, which is apparently iron oxide, occasionally indicate proximity to a source. In the Kubilis Quadrangle the serpentines have resulted chiefly from the decomposition of the peridotites and the pyroxenites, but some areas of the serpentine are probably the result of the decomposition of basic phases of the greenstone.

Many of the miners in prospecting for platinum had difficulty in determining whether or not the black sands of the region contained the metal, and at other times confused it with silver. In some placer deposits the grains of the platinum are coated with a dark film and somewhat resemble the grains of chromite, magnetite, or ilmenite, which in panning was confusing to the miners. During the visit of the geologists to the region, they showed the difference to the miners, and now most of them are able to detect the presence of platinum. The sodium-mercury amalgam is the principal agent used for collecting jointly the gold and platinum.

Late in 1916 the owners of the Highland quartz mine in the Gold Hill district were surprised, on receiving from the smelting company a report of a mill run, to find that the shipment, in addition to the gold and silver contained 0.032 oz. platinum. The ore was mined at a depth [illegible] ft. The [illegible] wall of the vein is [illegible] schist and granite, and the hanging wall is made up of serpentine, schist, and granite.. The Highland claim lies 12 miles south-west of Gold Hill, on the right fork of Foots creek,

at an elevation of 2600 ft. It was first worked about 20 years ago. The present workings are confined to the oxidized zone; the old workings were more extensive. The vein strikes NE. and dips about 35° SE.; the country rock is a micaceous sandstone. The owners of the mine, in an attempt to discover the source of the platinum found in the shipment, gave the walls of the vein a thorough test by both pan and assay but found no trace of platinum. They then looked to the vein-matter for the source. The vein-matter contains quartz of three colors, rose, amber, and blue. The blue quartz, which is quite dense, is pitted throughout with small cavities, which are lined with a black, sooty mineral, and filled with a decomposed irony matter. In crushing and panning this quartz it gave results high in platinum.

The mine is equipped with a 3-stamp mill, amalgam-plates, and one 4½ by 16-ft. Frue vanner. The ordinary sodium-mercury amalgam was used, which saved the platinum. The field survey of the Oregon bureau of mines was informed of this discovery, which occurred since the former survey in 1916, and while in this district the past summer it intended to make a thorough survey of this deposit. A forest fire, however, swept over the mine before the survey was made, destroying some of the underground work and making it unsafe, so that the work was left for another visit.

The accompanying illustration shows the Old Channel hydraulic placer mine in the Galice district in Josephine county. This is a typical placer mine in southern Oregon; since the investigations on the occurrence of platinum in these gravels its recovery has received careful attention, with the result that mines of this sort are now producing some platinum.

BRITISH COLUMBIA

ACTIVITIES OF THE GEOLOGICAL SURVEY.—MEETING OF THE CANADIAN MINING INSTITUTE.

Survey-parties representing the Geological Survey Branch, Ottawa, have been at work in various parts of British Columbia this summer. Some of them still are in the field, although the season may now be considered practically at an end. There also was a Yukon party under W. E. Cockfield engaged in making an examination of the silver-lead lode deposits of the Mayo country, the results of whose work will be awaited with considerable interest by mining men. Those parties whose activities were confined to the Province may be enumerated as follows: (1) Salmon river, head of Portland canal, in charge of J. J. O'Neill, who was the geologist with the Stefansson Arctic expedition. This is the zone in which is situated the Premier mine and a number of prospects of much promise. It is a district which, at present, is being developed on a large scale, diamond-drilling being under way on the Big Missouri and one or two other groups of claims. Mr. O'Neill's report, therefore, will be looked forward to with more than usual interest. (2) Cariboo country, in charge of R. R. MacKay, who is making a geological survey of the placer gold deposits. (3) Pacific Great Eastern Ry. section, between centres of Clinton and Quesnel, in charge of L. Reinecke, who is making a special examination and reports on the soda lakes of that area. (4) Slocan, in charge of M. F. Bancroft, who is completing a geological survey of the Slocan district started years ago. This work was almost completed by the late O. E. LeRoy, who went overseas and was killed in France. The late C. W. Drysdale then took up the work but, after getting well on with it, he was drowned in the Kootenai river. His records also were lost. This occurred in 1917. (5) West coast of Vancouver island, by V. Dolmage, who is making a reconnaisance of the coast line. (6) Britannia area, Howe sound, by S. J. Scholfield, who is making a detailed examination and preparing a geological map of the Britannia mineral zone. (7) Bridge River country, by S. C. McCann, who also is carrying on work on which the late Mr. Drysdale was engaged at the time of his death. Mr. McCann is preparing a geological map of the region. He now is visiting the Grass Valley district, California, for the purpose of comparing the geology and the mineralization of the Mother Lode district with that on the survey of which he is employed. (8) Coquihalla River section, by Charles Camsell, who is in general charge of geological survey work in British Columbia and whose headquarters are at Vancouver. Mr. Camsell was able to get into the field for a few weeks in order to make an examination of this country and his report will be available when the complete account of this year's activities in the Province is issued by the Geological Survey Branch, Ottawa.

KIMBERLEY.—The operation of the Sullivan mines of the Canadian Consolidated Mining & Smelting Co. are seriously hampered as a result of a strike of the metal-miners, which was declared during the third week in September. Their demand for an increase of $1 per day in wages was not acceded to and it is estimated that approximately 200 men walked out in protest. The North Star mine, owned by O. C. Thompson and J. L. McKinney, also is affected. This mine was expected to be on a shipping basis again shortly, the work of replacing that part of the plant destroyed by a recent fire having been carried through expeditiously.

VANCOUVER.—The announcement that the annual meeting of the Canadian Mining Institute will be held at Vancouver on November 26, 27, and 28 has been received with gratification by Western mining men. This action is accepted as indicating that the importance of the mining industry of the provinces of Alberta and British Columbia is becoming recognized throughout Canada. E. T. Hodge, professor of geology at the British Columbia University, has been apointed general secretary. He occupied a similar position in connection with the recent International Convention at Vancouver, the success of which was in no small measure due to his energy and intelligent direction. Mr. Hodge and the members of the committee of management already are engaged in the preparation of a program which, it is hoped, will make the first meeting of the C. M. I. held in Vancouver one of the most outstanding in the organization's history.

ATLIN ARM.—The Dolly Varden mine is developing better than the diamond drill operations underneath by the late owners foreshadowed. Some 1000 tons of ore averaging $30 per ton already was [illegible] shipped, and the railroad is kept busy on this account each week. It is said that improvements will be made in the line and rolling stock added so that the company will be able to haul custom ore to tidewater. Extensive development is being pushed at a number of mines, and these will require transportation facilities in the spring, while at the present time several mines are in a position to ship small batches of ore if the necessary transportation were available. The North Star, which is being operated by the Taylor company, is packing sacked ore on horses to the [illegible] camps. The Hollinger, which had 1300 men on its payroll a short time since, has now only about 1000, and is only able to operate [illegible] of its 2000 stamps. The Dome has only approximately 300 men at work, the McIntyre 400, and the Davidson 85. This exhausts the list of the producing mines, many of those formerly operated being closed down for the present owing to the handicaps of labor shortage and the high cost of supplies. The mine managers are hoping that the vocational training of returned soldiers may prove a source of relief.

AN ICE BRIDGE NEAR THE TERMINAL MORAINE OF THE ILLECILLEWAET GLACIER, ATLIN MINING DIVISION, BRITISH COLUMBIA

Dolly Varden railroad. It is expected that $30,000 will be realized from the shipment. The mine is looking well, the main tunnel being in ore that shows native and ruby silver freely. Mr. Meenach, of Seattle, who recently bonded the Muskateer group, has discovered ore running $200 in gold and 135 oz. in silver per ton. Price and Crawford, of New York, have bonded the Tiger property, for $25,000. David J. Hancock, who took over the United Metals earlier in the year, has two 12-horse pack trains transporting ore to tidewater.

ONTARIO

SHORTAGE OF MEN AT PORCUPINE.—COBALT RECOVERING RAPIDLY FROM THE EFFECTS OF THE STRIKE.

PORCUPINE.—The gold mining industry is greatly hampered by labor shortage, and the situation in this [illegible] COBALT.—This district has recovered rapidly from the effects of the strike. The majority of the leading mines are operating at full capacity and large shipments of ore and bullion were made for the week ended September 27, the Nipissing sending out 225,557 oz. of bullion and the Mining Corporation 68,603 oz. The lower workings of the Nipissing will be completely dewatered by October 5. The Beaver is taking out considerable high-grade ore from its upper levels. At the La Rose a rich find of high-grade has been made on the 100-ft. level and a good vein of high-grade is being opened on the Princess property. The shaft on the University is being pumped out and driving will be started on a good vein encountered just before the strike. This company is now producing more ore than at any time in the past five years.

ELK LAKE.—There are many indications of a revival in this district. The Paragon-Hitchcock is down to the

[illegible] and is [illegible] at the Lake. Native silver [illegible] showing in one of the drifts. Interests represented by Thomas Flynn of the Mattabi company have taken an option on the Silver-Alliance and will endeavor to develop the [illegible] which yielded rich high grade in the earlier days of the camp. Luke Ryan has disposed of a claim in Smythe township to Chicago purchasers for $30,000. Other deals with prospective American buyers are in progress.

Larder Lake.—The Argonaut Gold Mines has been organized in Montreal to take over La Mine d'Or Huronia, situated near Beaverhouse Lake, and a number of the adjoining claims. The mill installed on the property some years ago has been reconstructed and will be used as a testing plant. John W. Morrison, who was manager of the Lake Shore mine, Kirkland Lake, for some years, has been appointed general superintendent.

Gowganda.—A number of new prospects are being developed and machinery installed in some cases. The Northern Mining company's property, which was closed down during the War, is undergoing inspection with a view to resuming development. At the Castle, which is being worked by the Trethewey under option, a new find showing rich ore has been made on the surface. The Campbell has installed a mining plant brought in from the old Foster mine of Cobalt.

MANITOBA

RAILROAD PROPOSED FROM THE PAS.

Copper City.—The new district which is being established at the mineral field near Copper Lake, north of The Pas, will be known as Copper City. The Manitoba government is anxious to promote the development of this area and is urging the Canadian government to construct a railway from The Pas to the new field, a distance of 72 miles. The matter is under consideration and as a preliminary step J. B. Tyrrell is making an examination of the mineral deposits of the area for the Canadian government to ascertain whether they are of sufficient importance to justify building a railroad. Should the authorities at Ottawa refuse to take action the project may be taken up by the Provincial government.

MEXICO

DEVELOPMENTS AT LAS CHISPAS.—YAQUIS STILL CAUSE TROUBLE IN THE MOCTEZUMA DISTRICT.

Las Chispas.—Antonio Pedrazzini, manager of Las Chispas, has gone to Europe to interview Pedro Pedrazzini, president of the company, relative to improvements in the equipment, considered necessary to maintain production at the present rate. During the last two years Las Chispas has produced 3,500,000 oz. of silver, but owing to deterioration of equipment during long shutdowns, and because the greater part of the ore now blocked out is of lower grade than that formerly worked and of [illegible] character no such output may be maintained in the next two years without extensive overhauling of equipment. Considerable new milling equipment is planned for by Mr. Pedrazzini if [illegible] and other stockholders resident in France and Switzerland agree. The Babacanora mine, adjoining Las Chispas, operated by F. Oldfield Bostwick and Hoval A. Smith, recently installed a flotation process which is reported to be operating successfully upon the same character of ore as found in Las Chispas. The orebodies of this district are said to be largely low-grade with occasional rich pockets. The labor problem of the district, a difficult one a few months ago, is looking much better as there is a surplus in the district at present and no difficulty is experienced in getting trained men to do any sort of mine or mill work.

Canario.—The Canario Copper company, a New York corporation, is developing two deposits of low-grade copper ore, averaging 2 and 2½%, respectively. The principal work now is being done on the Lily group, near Nacozari. A large tonnage has been developed already, but James P. Harvey, president and managing director for the company, is counting upon opening a sufficient body to guarantee a supply for a large mill for a considerable number of years before this phase of work has been passed. Fifty men now are employed on the Lily. A wagon road will be built in the immediate future from this group to the Batamote group, four miles away. Two trucks, a two-ton and a half-ton, are operated by the company to freight supplies from Nacozari over the excellent wagon road which has been built. The district in the vicinity of Nacozari has been quiet and law-abiding for a long period, but on September 26 four Mexicans, armed with ropes and knives, attempted to capture Mr. Harvey with the avowed intention of robbing and murdering him. Mr. Harvey was riding alone from the property to Nacozari, but fortunately was armed with a revolver. Alighting from his horse, he placed his back against the abutment of a bridge on the Nacozari railroad near Cuesta Castilla, and fortunately was able to overawe the men without shooting. He forced them to ride ahead of him until they were near Nacozari, when he allowed them to turn off the trail. Going into town he obtained the assistance of Presidente Perraza, who with a file of soldiers took the trail of the four men and soon captured them. At last report the amateur highwaymen, all of whom formerly had been employed by the Canario and who, it was discovered, believed Mr. Harvey had part of the company payroll on his person, still were in jail awaiting trial. Arrivals from the lower end of the Moctezuma district report that although there have been no incursions of Yaquis since the holding up of the San Nicolas and Archipelago mines several weeks ago by a band of 80 Indians, an insidious form of terrorism was created by the raid which has rendered more difficult the already bad labor condition. Although reliable information has been received that after the robbery of the San Nicolas and destruction of the assaying and office equipment of the Archipelago, the Indians rode southward into the Sahuaripa district, every day or two Indian 'scares' visit the small mining camps of the Moctezuma-Cumpas district, distracting attention from work in hand and lowering efficiency to a marked extent.

CALIFORNIA

Alturas. The Hess Gold Mining Co. is planning to sink a new shaft to a depth of 550 ft. The present shaft, sunk on the site of the original discovery, is only 350 ft. deep. The new shaft will be in a more favorable location.

Auburn.—The Rising Sun Gold Mining Co. is re-opening the Fabled mine in eastern Placer county, under the management of E. C. Klinker. The property produced much gold in pioneer days but has been closed many years through litigation. An electric hoist and other equipment have been installed.

Junction City.—Preliminary work has begun at the Jacob placer mine in the Red Hill district, recently purchased from the Jacob estate by Jafet Lindeberg, Alaskan mine operator. The purchase price was $22,000, payable within three years, with 20% of the gross output to be paid the estate. The Jacob is well equipped and has produced well.

Portola.—Robert A. Kinzie, superintendent of the Engels Copper Co., has announced that persistence of the main sulphide orebody in the Engels mine has been demonstrated to a depth of fully 560 ft. below the lowest developed point, a total depth of 1000 ft., by diamond-drilling. The company has decided to consolidate the two reduction plants to lessen operating costs, with the mill to be at the lower camp. The ore is being mined by the shrinkage system.

Sonora.—National Gold Mines, operating National quartz mine near Priest's station, has decided on the erection of a 10-stamp mill, hoist, and other equipment. Jesse Mangante of Sonora is resident agent and William Treton, superintendent. The vein has been opened by a 250-ft. tunnel and ranges from 3 to 21 ft. wide. A shaft is to be sunk near the face of the adit to open vein at depth.

Weaverville.—The Globe mine near Dedrick has been sold by the Globe Mining Co. to the Bulkeley Wells interests. The new owners have eight men at work under the superintendence of Roy H. Elliott. The Globe is about the highest quartz mine in the State, and it has lain idle for two years.

NEVADA

Mina.—P. A. Simon, president of the Simon Silver Lead Mines Co., announces that Burch, Hershey & White have accepted the position of consulting and directing engineers for his property at Mina. Mr. Hershey has already visited the mine, and outlined a course of development which augurs well for the future of the property. M. W. Hayward, of the American Metals Co., spent several days in Mina last week in the interests of his company. He inspected a number of mines in the Simon district, and expressed himself as being much interested, particularly in the Simon Silver Lead and the Simon Fagan. F. W. Royer of Los Angeles was in Mina for a short time last week, and promises a return visit soon. A. H. Elftman of Tonopah was in the district last week in the interests of a group of San Francisco capitalists, who are said to contemplate large operations here. Mr. Elftman inspected and sampled several properties while here, among them the old Pactolus mine, now the property of the Tonopah-Shawmut Co., the Loo mine, and the Olympic. His report on these properties is awaited with much interest.

National.—High-grade gold-silver ore has been opened on the Buckskin National by a lease operated by Forrest Eell and Chris Choats.

Wellington.—A 40-ft. vein carrying gold and silver ore has been uncovered on the Klondike, owned by J. J. Herndon and S. O. Dykes. Rich seams occur mixed with the low-grade.

IDAHO

Coeur d'Alene.—The Silver Dale & Big Hill Mining Co. has issued a favorable report, foreshadowing a resumption of operations when the water supply improves.——The Sterling Silver Mountain Mining Co. has resumed operations on its property on Big Creek.——An extensive program of development has been outlined for the Linfor Copper Co.'s holdings.

Pioneerville.—The Golden Age Junior Mining Co. is shipping its seventh car of concentrate and is preparing to drive an adit to open the mine.

MONTANA

Iron Mountain.—The Intermountain Copper Mining Co., having a property near Iron Mountain, resumed operations recently and has been proceeding steadily since on a one-shift basis, according to Edward Evans, president. "A carload of concentrate and two carloads of crude ore have been shipped since the latter part of August," said Mr. Evans. "The crude ore was obtained in cleaning out the bins and an old stope. A carload of it had a copper content of 13%, but the content of the other car was not so high."

UTAH

Salt Lake City.—With a view to bringing employer and employee closer together in the present revolutionary state of world affairs, R. C. Gemmell, general manager for the Utah Copper Co., has given out a statement made to his men as follows:

"With the object of maintaining the present pleasant relations existing between the management and the employees, the Utah Copper Co. invites the employees to select a representative committee to consult with the managing and superintending officials on subjects of mutual interest. Although we are proposing that the men deal with the officials through elected committees, nevertheless I wish to state that the offices of the company officials will continue to remain open to all employees for the discussion of any and all subjects of mutual interest. In September ballots will be furnished at the time office for the election of an employees' committee to consist of three members from each division. Each employee will vote, by ballot, for three members in his division. The ballots will be deposited in a ballot box in the time office, and the employees will be requested to select a committee of three to act jointly with a similar committee appointed by the management to supervise the election and count the ballots. Only employees shall have the right to vote. No official of the company, foreman, nor any person having the right to employ, remove, or discharge an employee shall be entitled to vote. The three candidates in each department receiving the highest number of votes will be declared elected."

WASHINGTON

Loon Lake.—Mining claims in this district have been upheld against the rights of a homesteader. The decision affects valuable mining property.

Loomis.—New York interests headed by Charles Dempster have leased properties of the Copper World Gold Mining Co. six miles from Loomis. It is reported that they will spend $25,000 within a year in development and equipment. The same interests own an adjoining property and shipped 4000 tons of ore in 1918.

Northport.—An ore chimney of value has been discovered on the Gladstone property in the Northport district. The property will ship in the spring.——Ore has been discovered in a new place on the Electric Point property near Northport.

Oroville.—Arkins and Grant, lessees of a property and stamp-mill near Oroville, are shipping their first car of concentrate. A valuable discovery is reported on the Alice claim adjoining.

BRITISH COLUMBIA

Woodbury Creek.—Operation of the Highland concentrator of the Consolidated Mining & Smelting Co. has been resumed after a suspension of seven months. Development was continued in the period of milling inactivity. The purchase of adjoining properties has increased the Highland group to seven claims.

PHILIPPINE ISLANDS

Benguet.—The Benguet Consolidated Mining Co. treated for the first half of the current year 8550 tons of ore with an average gold content of $25.70 per ton. The recovery was 92.4%, a total of $209,331, or $24.47 per ton. Operating expenses were $9.45 per ton, leaving a profit of $13.50 per ton. Dividends amounting to $75,000 were paid. Operations were greatly hampered by lack of men during the spring months, with consequent low tonnage and high costs per ton.

Personal

[illegible] invites members of the profession to send particulars of their work or movements. The information is interesting to our readers.

Hallet R. Robbins is in New York.

W. de L. Benedict returned to New York by way of Los Angeles.

Graham Cruickshank has returned from France to Rossland, B. C.

Louis A. Wright has sailed from New York for Rome, on his return to Italy.

S. H. Dolbear has returned from an inspection near Downieville, California.

F. W. Bradley is expected in San Francisco, from Alaska, toward the end of October.

William A. Argall, of Denver, has joined the staff of the Alaska Gold Mines, at Juneau.

Austin F. Rogers has returned to Stanford University from a geological trip to Siskiyou county.

S. J. Speak, of the firm of Hooper & Speak, London, has arrived in New York on a tour to the zinc-reduction plants of this country.

J. F. Mitchell-Roberts has resigned as assistant manager of the Suan Concession and is now on his way from Korea to San Francisco.

William Motherwell has returned from Mysore, in India, to San Francisco, having spent four months on the way, owing to the disorganization of shipping.

Urie Brown, James W. Gwynn, Cy. Garber, and **Lester Benson** have returned to Kellogg, Idaho, from Council, Alaska, after investigating the Omilak prospects.

Julius M. Cohen returned from France in command of the 319th Engineers. Major Cohen was Chief Engineer of Construction, and Camp Engineer for the past year at Camp Pontanezen, near Brest.

The accompanying photograph will interest our readers. It represents the judge, the lawyers, and the geologists that took part in the recent Elm Orlu v. Butte & Superior lawsuit. In the background is the Federal Building, at Butte, where the case was tried. The top row, from left to right, shows W. H. Emmons, W. B. Fisher, Fred Searls, Jr., John Templeman, W. A. Clark, Jr., Will Rossberg, Rush White, and Walter Lytzen. The bottom row consists of William Scallon, Albert Burch, Walter H. Wiley, Darcy Bard, Horace V. Winchell, George M. Bourquin (the Judge), James F. Kemp, W. K. Leith, John Gray, J. B. Kremer, Sidney Sannet, William Wallace.

THE METAL MARKET

METAL PRICES

San Francisco, October 7

Aluminum, dust, cents per pound	60
Antimony, cents per pound	9.50
Copper, electrolytic, cents per pound	21.00—23.50
Lead, pig, cents per pound	6.40—7.50
Platinum, pure, per ounce	$130
Platinum, low iridium, per ounce	$150
Quicksilver, per flask of 75 lb.	$95
Spelter, cents per pound	9.00
Zinc dust, cents per pound	11.00—13.50

EASTERN METAL MARKET

(By wire from New York)

Oct. 7.—Copper is inactive and easy. Lead is dull, but firmer. Zinc is quiet and stronger.

SILVER

Below are given official or ticker quotations, in cents per ounce of silver 999 fine. From April 23, 1918, the United States government paid $1 per ounce for all silver purchased by it, fixing a maximum of $1.01½ on August 15, 1918, and will continue to pay $1 until the quantity specified under the Act is purchased, probably extending over several years. On May 5, 1919, all restrictions on the metal were removed, resulting in fluctuations. During the restricted period, the British government fixed the maximum price five times, the last being on March 26, 1919, on account of the low rate of sterling exchange, but removed all restrictions on May 10. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the normal rate of exchange.

Date	New York, cents	London, pence	Average week ending	Cents	Pence
Oct. 1	118.87	64.00	Aug. 30	115.00	60.66
2	119.00	64.75	Sept. 6	111.45	58.93
3	120.75	63.00	13	111.99	60.96
4	118.37	64.00	20	113.33	61.14
5 Sunday			27	114.10	62.04
6	120.00	64.00	30	117.70	63.14
7	120.37	63.00	Oct. 4	119.56	63.71

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	75.14	88.72	101.12	July	78.97	99.62	106.36
Feb.	77.54	85.79	101.12	Aug.	85.40	100.31	111.35
Mch.	74.13	88.11	101.12	Sept.	100.73	101.12	113.92
Apr.	72.51	95.35	101.12	Oct.	87.38	101.12	....
May	74.61	99.50	107.23	Nov.	85.97	101.12	....
June	76.44	99.50	110.50	Dec.	85.97	101.12	....

COPPER

Prices of electrolytic in New York, in cents per pound.

Date		Average week ending		
Oct. 1	.21.50	Aug. 30		22.83
2	.21.50	Sept. 6		22.55
3	.21.37	9		22.37
4	.21.25	16		22.20
5 Sunday		23		22.10
6	.21.25	30		21.58
7	.21.25	Oct. 7		21.35

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	29.53	23.50	20.43	July	29.67	26.00	20.82
Feb.	31.57	23.50	17.34	Aug.	27.42	26.00	22.51
Mch.	30.00	23.50	15.05	Sept.	25.11	26.00	22.10
Apr.	33.16	23.50	15.23	Oct.	23.50	26.00	....
May	31.09	23.50	15.91	Nov.	23.50	26.00	....
June	32.57	23.50	17.53	Dec.	23.50	26.00	....

LEAD

Lead is quoted in cents per pound, New York delivery.

Date		Average week ending		
Oct. 1	6.10	Aug. 30		5.88
2	6.15	Sept. 6		5.90
3	6.15	" 9		5.83
4	6.15	" 16		5.97
5 Sunday		" 23		6.20
6	6.20	30		6.07
7	6.20	Oct. 7		6.16

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	7.64	6.85	5.60	July	10.93	8.03	5.53
Feb.	9.10	7.07	5.13	Aug.	10.75	8.05	5.78
Mch.	10.07	7.26	5.24	Sept.	9.07	8.05	6.02
Apr.	9.38	6.99	5.05	Oct.	6.97	8.05	....
May	10.29	6.88	5.04	Nov.	6.38	8.05	....
June	11.74	7.59	5.32	Dec.	6.49	6.90	....

TIN

Prices in New York, in cents per pound:

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	44.10	85.13	71.50	July	62.60	93.00	70.11
Feb.	51.47	85.00	72.44	Aug.	62.53	91.33	62.20
Mch.	54.27	85.00	72.50	Sept.	61.54	80.40	55.79
Apr.	55.63	88.53	72.50	Oct.	62.24	78.82	..
May	63.21	100.01	72.50	Nov.	74.18	73.07	.
June	61.93	91.00	71.83	Dec.	85.00	71.52	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound:

Date		Average week ending		
Oct. 1	7.35	Aug. 30		8.00
2	7.40	Sept. 6		7.89
3	7.40	9		7.76
4	7.45	16		7.62
5 Sunday		23		7.50
6	7.55	30		7.38
7	7.60	Oct. 7		7.46

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	9.75	7.78	7.44	July	8.98	8.72	7.78
Feb.	10.45	7.97	6.71	Aug.	8.58	8.78	7.81
Mch.	10.78	7.67	6.53	Sept.	8.33	9.58	7.57
Apr.	10.20	7.04	6.49	Oct.	8.32	9.11	....
May	9.41	7.92	6.43	Nov.	7.76	8.75	....
June	9.63	7.92	6.91	Dec.	7.84	8.49	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. Prices, in dollars per flask of 75 pounds:

Date			Sept.	23	
Sept.	10	104.00		30	105.00
	16	104.00	Oct.	7	94.00

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	81.00	128.06	103.75	July	107.00	120.00	100.00
Feb.	126.25	118.00	90.00	Aug.	115.00	120.00	103.00
Mch.	113.75	112.00	72.80	Sept.	112.00	120.00	102.60
Apr.	114.50	115.00	73.12	Oct.	107.00	120.00	....
May	104.00	110.00	84.80	Nov.	102.50	120.00	....
June	85.50	112.00	94.40	Dec.	117.42	115.00	....

FOREIGN EXCHANGE

Continental rates were held somewhat steady this week in contrast to sterling, which recorded a slight net advance. Nevertheless the tone of the market remains decidedly uncertain, with predictions still confident in some quarters that much lower levels may yet be seen before the current turns permanently upward. Speculation also continues to be more than to the usual extent a factor in exchange markets. As regards such interest in German marks the point is made that considerable uncertainty may arise in regard to buying of checks on Germany, which are simply orders of banks here to effect payment in Germany, and may not prove permanently valid. One of the largest German banks is said to have served notice that the time between issue and presentation of checks issued in America and payable in Germany may not exceed two months.

In a recent speech on industrial conditions in Europe as they affect the need for credit and raw materials, George E. Roberts, vice-president of the National City Bank of New York, said in part:

"The War has touched us lightly. We are a richer people than when it began, with greater productive capacity. Our wealth and productive capacity are one-third to one-half that of the world. We have what Europe needs to restore her industries. We have the financial ability to give relief. We were a debtor nation before the War; we came out a creditor nation. We have bought back American securities held in Europe at very low prices, by selling war materials and foodstuffs at very high prices, and they are heavily in debt to us besides.

"There are only three ways in which international payments can be made: First, in commodities of trade, but Europe is unable to pay in these, she needs to import them. Second, in gold, but they have no gold they can afford to spare. We have just received $158,000,000 gold from Germany for food. That must have been nearly half all she had, and I am sure some other settlement was not found. We don't need that gold, we have too much now, and to ship ours means a loss of credit and industrial life. Gold will merely inflate our credits and prices still further. The third means of payment is by promises to pay in future, and this is the only way our export trade to Europe can go on.

"Before we entered the War we received over a billion in gold from Europe, but after we entered our Government began to make loans to allied governments, to furnish the means of making purchases here. Congress set the limit at $10,000,000,000, and something over $9,600,000,000 has been loaned, over $2,000,000,000 since the armistice. Power to make these loans is nearly exhausted, and other means of supplying credit must be found or our exports will fall off.

"Allied governments have abandoned efforts to stabilize exchange, and the decline increases cost of American goods. Discount on the pound is 15%, on the franc over 40%, on Italian money over 50%. We think prices high, but how can the French pay them, and pay high transportation charges and 10% on top for exchange? Italy produces no coal or oil or steel or cotton; how can she buy them at such cost? Coal is over $100 per ton in Italy, and little is to be had. Before the War Italy and France imported coal from Great Britain, but British production has declined until there is little to spare. America is the only resource."

Quotations on October 7 are as follows:

Sterling	Cable	4.32
	Demand	4.31
Francs	Cable	8.34
	Demand	8.36
Lire	Demand	9.72
Marks		4.40

Eastern Metal Market

New York, October 1.

The steel strike has been and still is interfering with business in all the non-ferrous markets. This is particularly true of tin.

Demand for copper is light and the price tendency is easy. Quotations vary as to the sales involved as well as the quantity.

Spot tin is firmer but demand in general is slow.

The lead market is quiet, but quotations are in the main firm but slightly changed.

Prime Western zinc is lower with few sales reported.

IRON AND STEEL

The steel strike has entered its second week and it can be safely stated that the advantage is with the employers. In most districts where the effect was the worst many men have returned to work or are gradually doing so. A tie-up of the entire industry has failed. A serious attempt, well organized, to close up all the plants of the Bethlehem Steel Corporation on Monday failed miserably. Counter claims are given out by both sides but it seems assured that not one of this corporation's plants, which are situated in six or eight different and widely located cities, has been seriously if at all affected. In the meantime, business in general is held up. Although some orders are being taken the disposition is to wait until the skies clear. A strike of pressmen and feeders in the New York district was started September 30, one day ahead of the schedule. This has thus far seriously interfered with the publication of all trade papers in the city. What the outcome will be is not known. Some papers, like 'The Iron Age', will issue special market editions.

COPPER

The market is in a unusually chaotic condition as to prices and a fair appraisal is difficult. It appears that the leading or large producers continue to maintain their quotations at 23.50c., New York, for both electrolytic and Lake copper for October and last quarter delivery, but that they are doing practically no business. Another set of sellers, presumably smaller producers and some speculators, are quoting about 22.50c. for the spot and early delivery, while less influential sellers are prepared to sell at as low as 21 50 to 21.75c., New York, for spot and October delivery. Just how much business is being done is uncertain. There are reports that considerable quantities have been sold at the last two levels. Demand, however, on the surface does not seem to be of consequence and the market is a quiet and waiting one, due of course to the steel strike and other adverse labor conditions. Sales of some magnitude are reported to certain foreign consumers, chiefly France and Scandinavian countries, but the labor troubles in England and the consequent uncertain shipping situation are now holding up further sales.

LEAD

Extreme dullness pervades the market. There are offerings of outside lots as low as 6c., New York, but these are limited. Most of them are easily absorbed. It is difficult to quote the market satisfactorily in present circumstances, but a fair appraisal seems to be 6.05c., New York, for October delivery with St. Louis as a base at 5.85 to 5.95c. The American Smelting & Refining Co. has not changed its quotations of 6.25c., New York and 6c., St. Louis.

TIN

It is generally conceded that the steel strike has affected the tin market to a greater extent than any other. A little business has been done in both the spot and future shipment markets, but in general dullness rules. The spot market is a little stronger, due to the belief on the part of some that shipments from England will be interfered with because of the railroad strikes there. This is taken to apply both to Straits tin and to Lamb & Flagg. Yesterday spot Straits was selling at 55c., New York, as against 54.75c. the first of the week and late last week, and the tendency is upward. There is also a fair demand for tin actually afloat and sales of this have been made at from 54.25 to 54.70c. on such lots due to arrive in from two to ten days. There has also been a little business done in October-November shipment from the East at 53 to 53.25c. But until the steel strike is settled an active demand is not likely. The arrivals are wholly sufficient to meet present demands. Up to the latest advices these have amounted to 5120 tons for September of which 3695 tons has come in at Atlantic ports. The quantity afloat is put at 5130 tons. American pure tin is quoted at 54.62½c. and 99% pure at 53.75c. The London market was stronger yesterday at £275 10s. for Straits. The average quotation of tin for September was 55.79c., New York.

ZINC

There is no improvement in the situation and the market continues inactive and weaker. Prime Western for October delivery is not obtainable and has sold at 7c., St. Louis, or 7.35c., New York, which is quoted as the market. Later month's delivery is held at about five points per month above the October level. The steel strike is a particularly depressing factor for no galvanizers are eager to buy zinc under such conditions. The railroad strike in England is another adverse factor in that American bottoms have been ordered not to sail to England and this hinders what little export trade was going. This latter factor has its influence also in the copper market. In all departments of the zinc-market buyers and sellers are indifferent and not anxious to do any business under present conditions. The figures of the U. S. Geological Survey, recently published, are taken to indicate an over-production of zinc considering the needs of the recent past. About 43% of the 445,000 tons produced in 1917 was used in galvanizing.

ANTIMONY

The market is quiet and but few sales are reported. Wholesale lots for October delivery are quoted at 8.50 to 8.62½c., New York, duty paid.

ALUMINUM

No. 1 virgin metal, 98 to 99% pure, is unchanged at 32 to 33c., New York, for wholesale lots for early or October delivery.

ORES

Tungsten: The market is quiet and demand light. Quotations are more or less nominal at $7 to $10 for wolframite and scheelite with Chinese ore at $7.25 and Bolivian ore at $9 to $10 per unit in 60% concentrates. Ferro-tungsten can be obtained at about $1.15 per lb. of contained tungsten.

Molybdenum: Quotations are nominal at 75 to 85c. per lb. of MoS_2 in 90% concentrates.

Manganese-Iron Alloys: Because of the steel strikes business in ferro-manganese and spiegeleisen is very light. American producers of ferro-manganese, 80%, continue to quote $110, delivered. The Boston representatives here either quote $105 to $110, seaboard, or do not quote at all. Spiegeleisen is quiet but firm at $35, furnace.

Book Reviews

Chemical Calculation Tables. By Horace L. Wells. Pp. 43. John Wiley & Sons, Inc., New York. For sale by 'Mining and Scientific Press'. Price, $1.25.

The principal tables in this book give, respectively, atomic weights, gravimetric factors, atomic weights for the more common chemical formulas, reduction of gas-volumes to 0 and 760 mm., barometric corrections for temperature, multiples for organic compounds, weights and measures, and logarithms. The book will be useful to the chemist and the chemical engineer.

Steam-Engine Troubles. By H. Hamkens. Pp. 267, ill., index. The Norman W. Henley Publishing Co., New York. For sale by 'Mining and Scientific Press'. Price, $2.50.

This is a practical book for the operating engineer written in non-technical language so that anyone with enough intelligence and experience to run a steam-engine can understand it. Chapters are devoted to the various parts of the steam-engine and the possible troubles that may develop, also to such special subjects as foundations, erecting, valve-setting, and operation. The book is illustrated with nearly 300 small line-drawings. It will be of value to anyone who runs a steam-engine or has one run for him.

Directory of the American Association of Engineers. Pp. 190. Ill. American Association of Engineers, Chicago.

The Association is now three years old and has approximately 2200 members, mostly civil engineers, but a number from the other branches. Besides the material usually found in a society year-book there is a directory showing the condensed experience of each member. This is, presumably, mainly with the idea of presenting information in tabulated form to prospective employers. However, unlike most society year-books, addresses are given without information as to the position the member at present holds. This omission is the more remarkable because an employer is frequently more interested in what a man is actually doing than in what he has done.

Astronomy for Surveyors. By R. W. Chapman. Pp. 241, ill., index. J. B. Lippincott Co., Philadelphia. For sale by 'Mining and Scientific Press'. Price, $1.75.

This book is a sort of happy medium between the brief treatment of astronomical theory found in most textbooks on surveying and the highly technical discussion in an astronomical treatise. The first chapter contains a brief review of the principal propositions of spherical trigonometry. Several chapters are then devoted to discussion of theory, which is then applied to the practical problems of determination of the true meridian, of time, of latitude, and of longitude. The book will be of value both to students and to practical surveyors who realize, as most of them should, that their knowledge of the astronomical basis for their work is entirely too limited.

Oxy-Acetylene Welding Manual. By Lorn Campbell. Pp. 148, ill., index. John Wiley & Sons, Inc., New York. For sale by 'Mining and Scientific Press'. Price, $1.25.

This book is intended as a manual for the practical welder, in fact, if anything, it errs too much on the side of the elimination of theory. However, the man that wishes to study the theoretical side of welding can find it discussed in other books. The present volume, after a brief introduction describing the principal uses of oxy-acetylene welding, discusses the apparatus and shop equipment and the general methods of operating the same. Most of the rest of the book is devoted to the special problems in connection with the various metals most commonly welded, including cast-iron, malleable iron, steel, brass, and aluminum. Another chapter considers the use of the oxy-acetylene torch in cutting metals, and there is also a chapter on the oxygen process for burning carbon from cylinders of internal combustion engines. The book appears to have been hastily written, and there are many sentences that could have been made less obscure by a little careful editing. However, it will be useful both to the practical welder and to the man learning the trade.

Applied Mechanics. By Charles E. Fuller and William A. Johnston. Volume II—Strength of Materials. Pp. 538, ill., index. John Wiley & Sons, Inc., New York. For sale by 'Mining and Scientific Press'. Price, $3.75.

This is a text-book prepared by two members of the faculty of the Massachusetts Institute of Technology. It is a good text-book, and makes no claim to be anything else. The mathematical discussion of the various principles involved is complete, and it is illustrated at the end of nearly every chapter by a number of problems. The student may, however, be disappointed to find that few of them are worked out for him, neither are there any 'answers' in the back of the book. The scope may be judged from the chapter headings, which are Physical Properties of Materials, Analysis of Stress and Strain, Uniform Stress and Uniformly Varying Stress, Stresses in Beams, Deflection of Beams, Continuous Beams, Combined Stresses, General Theory of Flexure, Columns, Shafting and Springs, Curved Bars, and Reinforced Concrete Beams and Columns.

Recent Publications

Method of Administering Leases of Iron-Ore Deposits Belonging to the State of Minnesota. By J. R. Finlay. Technical Paper 222, U. S. Bureau of Mines, 1919. Pp. 40.

Prices of Petroleum and Its Products During the War. By Joseph E. Pogue, assisted by Isador Lubin. U. S. Fuel Administration, Oil Division, 1919. Pp. 55, diagrams.

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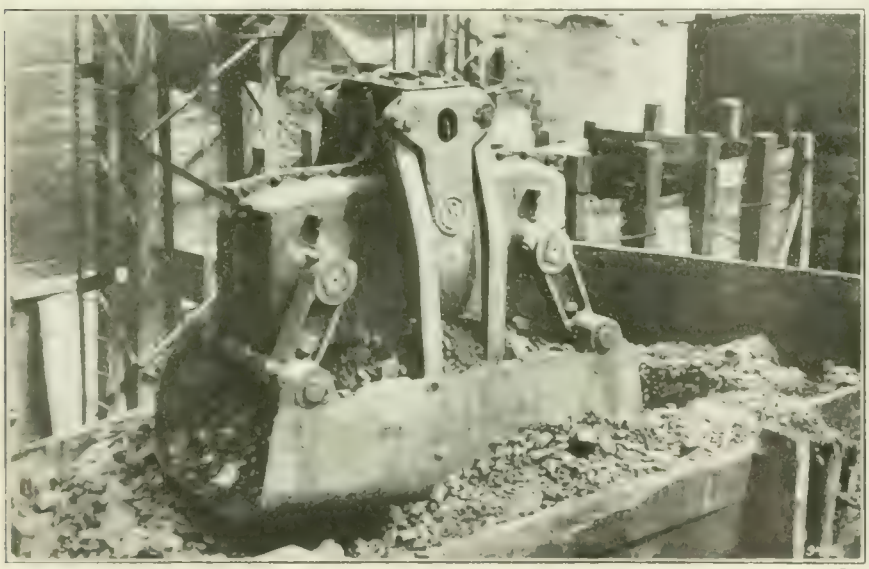
INDUSTRIAL PROGRESS

INFORMATION FURNISHED BY MANUFACTURERS

THE WELLMAN GEARED BUCKET

Throughout the entire field of handling bulk materials such as coal, sand, gravel, and cinders, the use of clam-shell buckets has been attended by expense and serious delays necessitated by the renewal of operating cables or chains. The ordinary construction of a clam-shell bucket is such that a large quantity of the material handled comes in contact with the operating parts, with the inevitable result of excessive wear, due to the abrasive action of the material and consequent delay and expense in removing and renewing the worn parts.

With the idea of eliminating these faults, the Wellman-Seaver-Morgan Co. has developed a bucket built in accordance with approved mechanical principles, possessing highly efficient digging qualities, minimum head-room, and a low centre of gravity, combined with neat appearance and durability. All the working parts are completely enclosed in a tight casing where they are constantly lubricated and where they do not come in contact with the material being handled. The bucket is composed of a minimum number of parts, so arranged as to facilitate the removal of any part in case of necessary repairs. It has no expensive chains or ropes reeved on small sheaves, no complicated parts or difficult adjustments. It is simple, compact, and efficient and is especially designed for handling coal, sand, gravel, and cinders. It is operated by two ropes and, consequently, can be handled by practically any type of two-drum hoist.



The Wellman Geared Bucket

Departing from the usual design of grab-buckets, which employ ropes or chains for their operation, this bucket has completely enclosed gearing to produce the necessary digging power. The power-casing, which forms the main frame, and from which the shells are suspended, is divided in a vertical plane through its longitudinal centre-line. These two sections are bolted together to form two tight compartments enclosing the operating gears, and a third compartment in the centre for the power-wheel and the deflecting sheaves for the operating ropes. The power-wheel centre is integral with the two bevel-pinions, which extend into the gear compartments and mesh with the operating segments. These segments are keyed to the operating shafts which are supported in bearings cast in the casing. The outer end of the operating shafts are finished square and support the rear bucket arms, which in turn are connected to the shell shafts. The cutting edges of the shells are pin-connected to the side bars, suspended from lugs in the top part of the casing. This method of supporting the shells produces a flat cutting path and turns the shells in such a manner that in penetrating the material, only the thin edge of the shell is presented, resulting in a high digging efficiency.

The excessively wide opening of the shells enables the bucket to fill in material which would otherwise be too shallow. The shells are open at the back to prevent compression of the material when the bucket is closing. The rigid connection of the rear arms to the operating shafts and to the shell shafts ensures positive alignment of the shells; and side lash is further prevented by side-bar guides attached to the shells. It is very important, when handling fine dry materials, that the shells shall register accurately when the bucket is closed. As the operating gears are completely enclosed by the casing, it is impossible for them to come in contact with the material the bucket is handling. On this account complete lubrication is possible and the wear of the parts is reduced to a minimum, at the same time the efficiency is materially increased.

A power wheel being directly connected to the pinions, the digging effort is the same from the beginning to the end of the closing operation. The opening of the bucket is effected by an opening rope attached to the small section of the power wheel, and wound in the opposite direction from the closing rope. In this way the bucket is opened for power, quickly and completely. On account of the small diameter of the closing pinions the bucket requires a very small amount of rope either for opening or closing, and is capable of high speed of operation.

The bucket is compact in design, requiring a minimum amount of head room for its operation. When open only a small part of the casing extends above the shells, resulting in remarkable stability on the pile, and little tendency to upset. The rope arrangement is such that the bucket is well balanced at all times, whether in the open or closed position.

SALES of copper during the past two months have been insignificant, it is reported, in contrast with the previous two months, but domestic consumption has expanded so cheerfully as to warrant the expectation of another buying movement soon. Europe's purchases have been small, being checked by the delay in the ratification of the Treaty of Peace and by the consequent lack of credit facilities. Japan and China are expected to come into the market as soon as existing political problems have been straightened out. The whole world needs copper and must buy most of it in this country.

OUR sympathies go to the technical press of New York, more particularly the 'Engineering and Mining Journal' and 'The Iron Age', because the strike of the local printing trades has forced a suspension of publication. More than two hundred other periodicals are similarly victimized by a strike that involves a breach of agreement and that has been outlawed by the American Federation of Labor. The charters of the local press-men and press-feeders in New York have been revoked or suspended by their respective international unions; their strike is against the best interests of labor and antagonizes public opinion flagrantly.

LUDENDORFF'S story of the Great War, as published in a number of papers in this country, has now come to an end. We have read it patiently, and we are glad it is finished. Two of the leading generals, French and Ludendorff, have now published their memoirs in a hurry, and neither has added to his reputation thereby. General Ludendorff exhibits the German ignorance of foreign opinion and the German obtuseness to the feelings of others. He dilates upon the hideous nightmare that proved the sequel of the German dream of world domination, but he assumes a complacent pose and blames it all upon the Socialists. History will pin him to his responsibility, the responsibility that he shares with the military clique, which fed the German people with ideas of conquest, ideas that in their conceit they swallowed eagerly, and as noisily as they dispatch their soup. In his description of the events of the War he tries to ignore the American participation and he belittles the performances of the American army, while making a shifty acknowledgment of the successive defeats administered to the German armies by the Allies before he and his friends did the 'kamerad' act in order to escape the consequences of their military collapse. Then they washed their hands of the whole affair and bewailed the collapse of the German spirit. It is a sorry spectacle, and Ludendorff has not given any dignity to it. His old chief, Von Hindenburg, has shown much better sense by abstaining from false heroics and by accepting the new regime.

WITH keen pleasure we are able to announce that Mr. Hoover has consented to accept the nomination to the presidency of the American Institute of Mining and Metallurgical Engineers. His election to the recognized leadership of the mining profession will be timely and appropriate, doing honor alike to the Institute and to the most distinguished mining engineer of this generation. Mr. Hoover was the guest of the engineers of San Francisco at a dinner on October 7, when he was welcomed and acclaimed by 350 members of his own profession. Mr. T. A. Rickard presided and made a short introductory speech, emphasizing the conclusion that today the economic factor is supreme and that the guest of the occasion was the supreme exponent of it. Mr. Hoover was kind enough not only to make a speech on economic conditions in Europe but to answer a number of questions put to him from the audience. These replies took the form of short supplementary speeches in which he threw light upon several of the darkest phases of contemporary history. The evening was one that will long be remembered. By Mr. Hoover's request, his speech was not reported, otherwise we would have taken pains to put it in print.

IT is satisfactory to note that the railway-men's strike in England has been settled by a compromise that means the defeat of the radical element. There was one incident of the strike that calls for comment, and that was the threat of the compositors employed on the daily newspapers in London to strike if the editorial comment continued to be unfriendly to the strikers. The threat was not made good and it is probable that the ending of the strike prevented any attempt to put it into effect, but it is worthy of record as evincing a spirit worthy of the worst forms of autocratic power, such as liberal men everywhere have learned to abhor. If either party to an industrial quarrel is going to beat the organs of public opinion into servile submission to their view of the quarrel, if independent utterance in the press is to be suppressed, and if the dominant party is to dictate the utterances of editors, we shall have lost at least a century of

[illegible] and we might as well be under the heel of a czar or a Kaiser. Even the threat of such a step is mean and cowardly. It seems such lack of confidence in the righteousness of their cause that we cannot wonder that the strikers have defeated.

MR. GRATON'S paper on the Federal taxation of mines is concluded in this issue. We have given a full abstract of it in two successive issues because it is a subject of immediate interest, not only to the tax-paying corporation but to the mining engineer engaged in the ordinary valuation of mines. Any rational scheme of taxation should be based upon the principles applied to the appraisal of mines for sale or purchase. For this reason Mr. Graton's paper is of double significance. In the first part he discusses the objects and methods of taxation for revenue, and shows how the regulations established by the Commissioner of Internal Revenue have been inspired by an increasing regard for fairness and equity as between the Government and the citizen. He informs us that his paper was written with the cognizance of the Revenue Bureau and for the purpose of eliciting the co-operation of the mining profession in drafting a technically correct and a politically equitable system of taxation on mining property. Thereupon he himself outlines the problems of mining economics as they affect the matter in hand, more particularly the large risk inherent in mining enterprise and the limitation of the supply of raw material upon which it depends for a profit. It is an industry of adventure on the one hand and of wasting assets on the other. Mr. Graton gives a summary of the successive tax enactments, emphasizing the steadily increasing rate of the taxes on income and excess profit. In the second part of his paper he goes to the roots of the problem and carefully analyzes the method of appraisal that is based upon the determination of the present value of eventual earnings. He refers to the writings of Messrs. H. C. Hoover, J. R. Finlay, and other mining engineers. This present-value method is not directly applicable to all mines; in order to apply it fairly it is necessary to introduce modifying factors, which Mr. Graton describes and discusses. Another difficult item is depletion, which can be estimated correctly only by aid of the experience gained in actual mining. We shall be glad to publish criticism or comment on this important paper.

THE New York 'World', like other newspapers, had its traditions enriched by the service given by sundry members of its staff in the War. Very properly, it decided to commemorate the fallen by means of a graceful and appropriate tablet. On this tablet appears the motto '*Pro Patria et Arma*'. In years to come the student will scratch his head in doubt whether the language be Latin or Esperanto, and when he concludes that it must be meant for Latin, he will wonder how it happened. However, instead of the correct form, *armis*, the editor of the 'World'—no, it could not be he; so let us say the office-boy—might have substituted *mundo*, just for local coloring, as it were. How this blunder would have shocked Joseph Pulitzer, who made the 'World' an influential newspaper and used to watch over its editorial columns with catlike keenness even after he became a blind neurotic and had to live abroad. In the 'Reminiscences' by one of his secretaries, Mr. Alleyne Ireland, it is related how he set large store on accuracy. "What a newspaper needs in its news," he said, "in its headlines, and on its editorial page is terseness, humor, descriptive power, satire, originality, good literary style, clever condensation, and accuracy, accuracy, accuracy!" His chronicler remarks that "Mr. Pulitzer made this confession with the warmth generated by an unshakable faith." This reminds one of the definition of 'faith' as believing things one knows to be untrue, for the 'World', as Pulitzer made it, was the first exponent of the yellow journalism that Hearst has developed to a pestilential nuisance. We may admire Pulitzer for his indomitable energy, which was hardly abated even by blindness, but we shall not forgive him for starting the prostitution of the American newspaper. A Hungarian Jew, he came to the United States when only sixteen, without friends, without money, and unable to speak a word of English. When 36 years old he had made enough money from the St. Louis 'Dispatch' to be able to purchase the 'World' from Jay Gould. Starting with a circulation of 12,000, he built up the 'World' until it had a circulation of 200,000 per day. He did this in four years of intensive effort, which put the 'World' in the front rank of the New York press and left him a complete nervous wreck, with the knowledge that his failing eyesight would in a few years develop into total blindness. Yet he continued to direct the management and policy of the 'World' until he died, in 1911. His life was a tragedy and the thing he did, much as he prided himself on having done it, was tragic also.

To Young Engineers

Good health is a decisive element in human happiness, as most men and women discover by experience sooner or later. Therefore we believe that we could do no better service to the young men of our profession than in publishing the text of Dr. Thomas Darlington's address on 'The Relation of Health to Work', which will be found in this issue. It has appeared in other publications, but that does not deter us from printing it again. We believe that it affords some of the most useful advice ever proffered by a physician and we feel confident that no intelligent human being can read it without deriving definite assistance from it in the protection of his health. The young look upon health as normal and do not bother about precautions so long as they are perfectly well; even if they trespass upon their strength or risk the consequences of impairing their physical faculties, they are not punished for it at first, because youth is the great healer and rectifier, but as they grow older they pay inexorably for their carelessness. With all the sincerity of which we are capable and with all the emphasis that written words will permit, we ask every young engineer

to turn to Dr Darlington's address and to read, mark, learn, and inwardly digest it. If he does, he will have permitted us to do him a service for which he will ever be grateful.

Mr. Hoover and Public Service

On another page we give the complete text of the speech delivered by Mr Hoover on the subject of the Treaty of Peace and the League of Nations. This speech was made before the Assembly of Stanford University and was transmitted, through the agency of the Associated Press, to the principal newspapers of this country. Whereas the leading Eastern papers printed it in full, our four San Franciscan papers gave only parts of it. The 'Examiner' placed a Senator Johnson head-line over the portion of Mr. Hoover's speech that it printed. The gentlemen editing our local papers ought to go to some school of journalism and learn the A B C of their craft; it is difficult to imagine anything more interesting at this time than a speech by the man of the hour upon the great topic of the hour. At any rate, we are glad to give our readers Mr. Hoover's speech in its entirety. We feel sure that it will be read by them with a keen and personal interest. Mr. Hoover is not a politician, therefore he does not view the subject from a parochial standpoint; he knows its bearing upon the future of the world and upon the welfare of the United States as a member of the comity of nations. His treatment of the subject is quiet and earnest; he speaks with full knowledge and deep conviction; the clap-trap of the half-informed politician is foreign to his style. We shall not take it upon ourselves to emphasize the points he makes, for they are accentuated with admirable clearness; rather we venture to turn to the subject of Mr. Hoover himself.

In San Francisco, as in New York, thoughtful men are asking one another how Herbert Hoover's remarkable ability and extraordinary experience may be utilized for the Nation. The mining engineer who was economic dictator of Europe is equipped for the biggest work to be done in the world today. His previous acquaintance with foreign countries has been supplemented by a unique opportunity to study the political and economic conditions of the European countries from top to bottom. He can think internationally, without abating one jot of his own nationalism, better than any man in the United States, not excepting even the President. To his sturdy Americanism he adds a knowledge of international affairs that is of immense value at this juncture when the United States finds herself impelled to assume the leading part allotted to her by the logic of events, by circumstance and by destiny. During the last two weeks he has addressed all the principal clubs in San Francisco, as well as other representative gatherings, and on each occasion he has created a deep impression, not by oratory, which he does not affect, but by a plain talk saturated with a knowledge of world affairs, more particularly the economic conditions in Europe and the impact of these conditions upon the political development of the countries devastated by war. He realizes fully and deeply, as a man of powerful mind and right conscience, what part the United States can take and ought to take in the readjustment of the great tangle that confronts mankind today. His audiences have been tremendously impressed as much by his unaffected sincerity as by his evident mastery of the subject. To allow a man so highly equipped to fall back into the narrow groove of inconsequential duties would be a pitiful waste of precious human material. He is only 45; he has shown the four qualities essential to leadership: the faculty of scientific analysis, executive ability, the power of organization, and the civic spirit, warmed by the love of his fellowmen and inspired by the divine spark of humanitarian service. He is, we believe, the most useful man in the world today. "Elect him President!" exclaim his admirers all over the country. Indeed, he is fitted for that exalted position, but the road to the presidency passes through the swamps of politics, and for politics of the ordinary kind Mr. Hoover has no use. He does not suffer fools gladly and for the insincerities of the political arena he has neither liking nor aptitude. He is not a partisan of either of the existing parties; formerly a Roosevelt Republican and later the loyal supporter of a Democratic president during a critical period, he belongs to a generation that has outgrown the political alignments of a bygone day. The cleavage between the two national parties is based upon a dead issue, that of the Civil War; the questions that excite us today are oriented in new directions and look to fresh horizons. Our political assignments are out of date; there is need for a new alignment, such as was attempted by the formation of the Progressive party, which, however, failed because it was linked to the Republican tradition. Mr. Hoover is the exponent of the liberal thought of this generation and will be a leader of the Liberal party of tomorrow, but we doubt whether his temperament or his ambition lead to the Presidency. An important post for which his experience would fit him is that of representative of this country on the Supreme Council of the League of Nations. The Council will be in continuous session, it will be immensely important, it will call for the very best men available, men of rare knowledge and sagacity. Mr. Hoover would fit the appointment, but we understand that it is proposed to assign this post to the latest ex-President, and it is anticipated that Mr. Wilson will nominate himself for it at the end of his present term of office. A post for which Mr. Hoover would be admirably fitted is the administration of the proposed Department of Public Works, in which are to be concentrated the engineering activities of the Federal government; but any such appointment is tied to politics, and, in any event, it does not afford sufficient scope for a man of Mr. Hoover's calibre. We think that a larger and a better task awaits him, namely, to organize and to inspire a great newspaper. Heaven knows we need one in San Francisco and in California! In a democracy the prime factor is education, for upon it is based the whole superstructure of representative government. We have two universities, both doing good work; Mr. Hoover is a

[illegible] Stanford and to might well be elected to the [illegible] presidency of Berkeley, but the people of this, or any other progressive community, are educated as much by their newspapers as by their universities. In this State the good work of our schools and universities is nullified by a group of the meanest and most meretricious newspapers in the English language. Three or four years of healthy mental training at college is perverted by thirty or forty years of newspaper pollution, such as is reflected in the debased tone of our municipal life. A straight, strong newspaper under the inspiring leadership of a great man would be wonderfully educative to the whole community, old and young alike. It would be a godsend to San Francisco, to California, and to the Pacific Coast, besides serving the highest national purpose. Mr. Hoover can get all the financial backing that might be required; and as for coadjutors, editors, and managers, he can draw upon the group of remarkable men whom he attracted to his staff in the beneficent work he has been doing during the last five years; among them he can find the talent and the character needed to produce a newspaper that will inspire good citizenship and stimulate the best ideals of Americanism. Is there any better work that he can do?

Concerning Strikes

Our local strike has been ended by an agreement on the part of the car-men to go back to work pending the submission of their claims to arbitration. The credit for this is due to the State Railroad Commission, which called representatives of the employees and the officers of the company in conference. A day before the strike was ended the two unions of electrical workers threatened to go on strike and plunge the community in darkness, in order, apparently, to force the traction company's hands. As the electrical unions were under agreement not to go on strike without 30 days notice, their action was a piece of sabotage—an act of social piracy. During the strike several men were killed and many more were injured by the use of fire-arms and clubs. The spectacle was seen of armored cars, manned by heavily armed guards, going down the streets of a city in time of peace. Why should anybody be permitted to carry deadly weapons contrary to the law? The car company pays taxes to the city, county, and State and in return, among other things, it is supposed to obtain the protection of the city, county, and State. It ought to obtain that protection and it ought not to be forced to arm its employees for their protection; indeed, it ought not to be allowed to arm them for any reason whatever. As for the strikers, the police—the properly constituted guardians of law—should have arrested any of them found carrying arms and ought to have prevented their assembling in mobs. If the police force is inadequate [illegible] sworn in; nothing should be spared in the effort to sustain the law. To us it seems that the fact of striking or the ending of the strike is much less important than the necessity of the Mayor to deal with the crisis and the inability of the police to assert the law against both sides. The difficulty was increased by the presence of the shipyard strikers, who, as the police records show, were largely responsible for the disorder and violence. During an attack on a street-car, the motor-man was greeted with cries of "Scab!" He did not retort for a while and [illegible] he did he laughed sardonically. "Scab, you say! While I was fightin' in France at $30 a month, you were being paid big wages for hidin' away in the shipyards."

Another strike has been settled, namely that of the miners in the Tonopah Divide district, in Nevada. This, like others, was started by the irresponsible radical element. They refused to arbitrate and they even refused to give the Governor a hearing when he attempted to address them. The agitators who fomented the trouble boasted openly that they had never worked in the mines, but had come there "to help the boys win the strike". They picketed the mines and threatened those who were willing to work. As stated in our Review of Mining last week, the strike was stopped by the organization of a union of the actual workers in the district and an agreement by the operators to guarantee a 15% reduction in the cost of living by means of a general store, to be run for the benefit of their employees, not as a source of profit to the companies. At the instance of the Governor, Mr. Emmet D. Boyle, a mining engineer, a restraining order has been issued by the District Judge at Tonopah against the I. W. W. leaders, enjoining them against incendiary talk and intimidation. Another strike that has fizzled out is the one in the Coeur d'Alene region of Idaho. This had involved all the principal mines except the Bunker Hill & Sullivan, at Kellogg, and it did not involve this particular mining enterprise because the management for twenty years had made a sincere effort to treat its employees humanely and squarely. We shall revert to this on another occasion; for the present we desire only to lay stress on the fact that one of the best preventives of labor troubles is the humane and considerate treatment of the workers, consistently and sincerely, not intermittently under threat nor insincerely for commercial reasons. It will be noted that most of the recent strikes have been started by un-American anti-social elements on the fringe of real labor, in the furtherance of a movement not so much to ameliorate the conditions under which men are working or to increase their wages as in the furtherance of a campaign of anarchy. The strike among the press-men in New York, like the one threatened by our local electrical workers, is in flat disregard of contracts and agreements. The only cure for that is to pass legislation compelling the unions to incorporate, so as to render them responsible for breach of contract, and then to hold the companies and the unions impartially to the observance of their obligations. The general lack of spirituous liquors to inflame the passions of the disputants has been one favorable feature, but, as we have insisted, the carrying of lethal weapons continues to be a bad symptom and it is an offence against the law that a democratic regime should not tolerate, [illegible] by the employer or the employee

Tariff Protection for Metals

The Editor:

Sir—There has been some discussion lately on the subject of placing a protective tariff on such things as quicksilver, chrome, and potash. No doubt such a tariff would stimulate some industries. From the point of view of a gold-miner, however, it appears that most of the industries are too much stimulated already. The demand for labor is certainly already greater than the supply, so why tax certain consumers and pay this tax to favored industries in order that they may go into the labor market and cause wages to go still higher? Everyone will admit that a tariff has the effect of raising prices, and yet there is a great cry going up that at present prices are too high.

It has been stated that it is desirable to produce quicksilver and other things in this country in order that we may not be left at the mercy of foreign producers. This does not seem to be a good reason for causing the consumers in this country to pay a higher price than foreign consumers for raw materials while the low-grade deposits in this country are being exhausted. It would seem better to give consumers here all the benefit of cheaper products until such time in the distant future as the foreign supplies become exhausted, when the law of supply and demand will raise the price to such a level that the mines in this country can be operated at a profit. Then both foreign and domestic consumers will have to pay the high prices.

A tariff on such an article as chrome does not in itself cause much hardship to domestic consumers, but a tariff on raw materials always results in a tariff on articles manufactured from the materials, and it is these resultant tariffs that cause inflated prices. For instance, suppose a tariff placed on chrome raises the price to what it was here while imports were cut off. The steel-makers will immediately require a tariff to protect them from competition with foreign steel produced with cheaper chrome. After this tariff has gone into effect, all manufacturers using steel will want protection from foreign manufacturers using cheaper steel. And so it goes.

It is difficult to persuade the poor gold-miner that it is to his interest to pay high prices for his quicksilver and blasting-caps in order that some other miner can operate a mine that is too poor to pay. There are plenty of gold mines, too poor to pay under present conditions, that are continuing in operation in the hope of lower prices in the future. If this hope be not realized, there is nothing left but to close-down.

So the effect of artificially increasing the value of the ore in one mine will result in decreasing the value of the ore in another, and cannot result otherwise.

ARTHUR B. FOOTE.

Grass Valley, California, September 29.

High Costs

The Editor:

Sir—In your editorial on this subject, in your issue of August 30, you make the statement: "Money is nothing more than a medium of exchange, a convenient yardstick by which the product of one man is measured in terms of the product of another."

I do not believe that your definition is quite complete. As far as I can see, a yardstick is a measure of extension only, and as such, of course, can be used as a means of estimating quantity, but it can never be an indicator of quality, while money must also perform the function of indicating the parity or disparity of quantities in terms of quality. I, therefore, would like to have you revise your definition so that it will indicate the degree of 'quality' contained in or ascribed to a specified 'quantity'.

J. MANLEY

Cleveland, October 2.

Flotation in Stages

The Editor:

Sir—I notice in the issue of September 20 an article by Will H. Coghill, entitled 'Flotation in Stages,' in which he apparently takes the stand that stage-grinding in conjunction with stage-flotation is something entirely new to the art.

On May 29, 1914, application for U. S. Patent, Series No. 841,710 was made by Ernest Gayford and George Crearar, and on March 21, 1916, patent No. 1,176,441 was issued, the same having been assigned to the Metals Recovery Company. The first claim in this patent reads as follows:

"The process herein described, consisting, essentially, in progressively reducing, by successive stages, ore mixed with water and a frothable agent having a preferential affinity for metalliferous matter, aerating the mixture resulting from each reduction, and floating off the concentrates liberated at each reduction."

The idea of the patentees at that time was not only increased recoveries but also to obtain a product containing

[illegible] material and therefore more acceptable to the smelters and easier to handle in the mill.

I note also that Mr. Coghill takes the stand that by excessive crushing, preceding flotation, many of the free and floatable mineral grains are so unnecessarily finely ground that a part of them is irrecoverable. Mr. Coghill has apparently taken his experience from the result of work on a particular molybdenite ore, and while in this case, owing to the physical nature of the material under treatment, the loss in the fine mineral particles may have been slight, our experience, when using pneumatic cells, has almost universally been that the finer sizes in the flotation tailings carry lower values than the coarser sizes.

In some mill-scale experiments recently completed, covering a period of 30 days and treating 50 tons per day, particular attention was paid to the value left in the flotation tailings after grading them, and it was found in every case that the minus 200-mesh material, which amounted to over 80% by weight of the total, was considerably lower in grade than any of the sizes above 200-mesh; and in some cases the minus 200 was 50% lower grade than the coarser sizes.

ERNEST GAYFORD.

Salt Lake City, September 25.

Gold, Prices, and War Debts

The Editor:

Sir—It is only recently that Mr. R. B. Brinsmade's communication on this subject in your issue of August 16 has come to my notice, and while, apparently, he has given considerable attention to the general subject of economics, it is evident that his ideas regarding the basic principles of money are somewhat clouded; because he says, "In the case of the monetary standard, gold, its exchangeable value has been arbitrarily fixed in legal tender by government fiat, and this creates an unlimited demand for it." Also, later on, in referring to gold mines, he says "The price, in money, of their product, being thus fixed by law." I understand the latter sentence to mean the price of gold, in money, being thus fixed by law.

In my several contributions on 'The Status of Gold' I have persistently endeavored to show that the exchange-value of that metal has not been fixed by government fiat, but Mr. Brinsmade seems to have overlooked this point of my argument. Permit me to try again.

When our Government enacted the law which made the unit of value 23.22 gr. of gold, the only arbitrary things it did was to declare gold to be the *standard* of value and 23.22 gr. of gold the *unit* of value. But what amount of other commodities, or goods, this unit of value may exchange for, or buy, in the marts of the world or at home, depends entirely upon the exigencies of trade and commerce as evidenced by supply and demand. Government fiat has nothing whatever to do with such exchange-value.

Furthermore, the word 'price' means the exchange-value of anything, *excepting gold* (as will, hereinafter, be explained) expressed in terms of the unit of value. Our unit of value is 23.22 gr. of gold, and the fact that 20.67 of said units weigh 480 grains has nothing to do with the exchange-value of gold; such exchange-value means the amount of other goods a stated quantity of it will bring in trade; that is, when it is swapped for something else.

The term 'mint price' per ounce has been applied to gold, but its true meaning is seldom understood. What it really means is the number of units of value into which an ounce of gold is divided in the process of minting, or coining. For a similar reason the 'mint price' of silver, also called 'coining value', is 1.29 'dollars' per ounce; which simply means that, in coining silver 'dollars', each 480 gr. of fine silver will make 1.29 dollar-pieces; but it has nothing to do with the bullion-value of the 371¼ gr. of fine silver in that 'dollar'.

Inasmuch as all exchange-values are relative, that is to say, comparative, it must, necessarily, be impossible to express the exchange-value of anything in terms of *itself*. This fact must be thoroughly understood. To say a ton of coal is worth 20 hundredweight of coal conveys no idea of exchange-value. Similarly, to say an ounce of gold is worth 20.67 units of value conveys no idea of exchange-value, for it simply means that 23.22 will go into 480 twenty and sixty seven hundredths times. The term 'price' as applied to gold, therefore, is clearly a misnomer, and it is just as much so as if the 'price' of a ton of coal is said to be 20 hundredweights of coal.

Recurring now to Mr. Brinsmade's statement that "In the case of the monetary standard, gold, its exchangeable value has been arbitrarily fixed in legal tender by government fiat," let us go back to 1896, when a bushel of wheat was valued at 19.5 gr. of gold; a bushel of corn at 6.5 gr.; and a pound of cotton at 1.63 gr. Relatively, therefore, a bushel of wheat was worth (exchangeable for) 3 bushels of corn or 12 lb. of cotton. At present, a bushel of wheat is worth 54.5 gr. of gold; a bushel of corn 34.8 gr., and a pound of cotton 8.1 gr. (yesterday's New York prices for wheat and corn. Cotton at 35c. per lb.; present quotations not available).

If, as Mr. Brinsmade says, the *exchangeable* value of gold has been arbitrarily fixed by the government fiat, why is it that it takes *now* nearly three times as much of it to buy a bushel of wheat, more than five times as much of it to buy a bushel of corn, and nearly five times as much of it to buy a pound of cotton as it did in 1896? The 'mint price' of gold is the same now as it was in 1896 but its "exchangeable value" is only from about one-third to one-fifth as much as it was then, as measured in wheat, corn, and cotton; and similarly for other commodities. Of what use, then, is the 'mint price' of gold in determining its purchasing power? There can be but one answer; it is of no use whatever.

In company with others, I am a producer of gold. At regular intervals we send our bullion-bar to market, where it is weighed and assayed and, in due course, we get an order on a banking-house for as many 'units of value' as it contains, less such as are deducted for refining, etc. In ordinary times we could send it to the

Mint and get gold coin for it weight for weight, less a small minting charge, and that is what is meant by "free coinage," but whether each 480 gr. of fine gold in the bar is divided, in the form of coins, into 1.03 parts (double eagles) or 2.06 parts (eagles) or 4.13 parts (half eagles) or 20.67 parts (dollars) has nothing whatever to do with the exchange value of the quantity (weight) of gold in each of such parts, or coins.

Government fiat arbitrarily declares the weight of gold that shall be put in each of such coins, but it does *not* declare what quantities of other commodities the possessors of such coins shall accept in exchange for them. Consequently, government fiat does *not* arbitrarily fix the exchangeable value of gold.

W. DE L. BENEDICT.

Del Monte, California, September 30.

A Job for Hoover

The Editor:

Sir—On a street the other day two bloated prosperous-looking fellows with pugnacious jaws were overheard in a fragment of conversation on the labor situation.

One asked, "Didja see that piece in the paper this mornin' about that city back east advertisin' fer street-sweepers at over $36 a week, an' in the same paper was an advertisement fer a collij perfesser at about $19 a week? Now, wot duh yuh t'ink o' dat?"

The sneering reply was, "Serves 'em right, de damn bone-heads. If dey had any brains dey'd organize."

The remainder of the conversation was lost in the crowd, but the portion overheard recalls a story that was published recently in 'Everybody's', in which the scion of a wealthy northern family was riding to town from a southern plantation beside an old negro who drove a six-mule team. This driver was very adept with the long black-snake with which he persuaded the reluctant mules from time to time. He cracked it with a report like a pistol-shot within an inch of one of the leaders; he cut to bits a horse-fly that was engaged in raising a welt on the fat side of one of the wheelers, without touching a hair; he snapped a bumble-bee from a flower fifteen feet from the road, and performed other feats showing his skill with the whip, to the delight and wonderment of his young passenger.

Finally, the boy spied a hornet's nest depending over the roadway and, in anticipation of some fun, he suggested to the driver that, as further proof of his proficiency with the whip, he might use it as a destroyer and cut the nest in half.

"Not on yo' life, honey," the skilful one replied, with a grin. "Ah knows Ah could do hit, an' Ah don't mine snappin' hoss-flies an' bummel-bees one het a time; but yo' all don't cetch me pesticatin' wiv no ho'net's nest. Dat's ohganized."

Now, is there not a germ of truth in the first speaker's criticism of the college professors, and does it not apply equally to us engineers and members of other underpaid professions? And is there not a valuable hint at a remedy in the foregoing paragraph? These men spend thousands of dollars and four or five of the best years of their lives in fitting themselves to train and educate others or to handle important operations in basic industries. Is it fair that they should receive less pay than unskilled laborers, or skilled ones who earned while they were learning and who emerged—or should have emerged—from their apprenticeship with money in the bank, instead of the debt which so often accompanies the diploma of the college graduate?

At this very moment a local labor agency is advertising for technical men (mill-men) at $4.50 per shift, with a dollar per day out for board. They must pay railroad and stage fare, amounting to nine or ten dollars, carry their own bedding, and live in desolate mountains away from family and friends, amid the most dreary surroundings. The same agency is hiring common laborers at $5 per day of eight hours, to work in San Francisco. And 65,000 men are striking for higher pay, within and about this same city.

Technical men of high qualifications go begging for jobs and are offered $100 to $150 per month to fill positions requiring several years in college and as many more in practical training in the field. Professors and instructors are given similar salaries in institutions of learning that are supposed to be well endowed. No wonder labor agitators sneer.

Something is wrong. Is there any other remedy than organization? And, if organized, how would desirable results best be accomplished? College professors may consider so practical a procedure as a strike altogether too business-like, too realistic; and engineers may consider it beneath their dignity, mining engineers especially having come to abhor labor-unions because of unpleasant experiences with agitators of the most radical type.

Of course, we have our societies and our institutions, all of which are very well so far as they go. But, aside from the interchange of knowledge and ideas, of what practical benefit are they? Organized brawn brings wide-spread pressure to bear to secure better pay or better living conditions, or to correct a real or fancied injustice to one of its members. Unorganized brain takes whatever scraps are thrown its way. Organized brawn maintains that "the laborer is worthy of his hire" and that every worker is entitled to a compensation sufficient to permit him to support a family in decency, and takes steps to secure such compensation. Must unorganized brain strangle its family or suffer the curse of bachelorhood when its perpetuation is more vital to the nation?

There are many engineers and some college professors who receive large salaries—or who, at least, have large incomes—but these are men of extraordinary ability or exceptionally good fortune. For these no appeal need be made. It is the average men, the rank and file, who need improved conditions—for the most part men of high ideals, strict integrity, energy, and knowledge, yet lacking in opportunity or business acumen, or possessed perhaps of some unfortunate personal factor that mitigates against financial success.

Living expenses have more than doubled within a few years; but where have the salaries of technical men or

educators advanced proportionately? Salaried men in general have been ground between the millstones of labor monopoly and capital monopoly, with only local and temporary relief from the torture. Permanent relief is a problem that can be solved only by men of strong influence, keen vision, and a knowledge of the conditions and requirements of this particular field of work. Such men are usually too busy or too careless of the problems of their less fortunate associates to undertake the solution. However, at this opportune time appears a man who can and who has the heart to do it. Compared with the work Mr. Hoover has been doing the past five years his present activities must seem trifling; so, before he again becomes too heavily loaded, he might be induced to undertake a work that would be of lasting advantage to the members of his own profession, as well as to many others.

The case is respectfully submitted to him.

R. H. Toll.

Berkeley, California, October 5.

Sampling Large Low-Grade Orebodies

The Editor:

Sir—Referring to my letter to 'Discussion' appearing in your issue of September 20, I have read your editorial on my letter and I am much surprised at it, knowing how careful your editorial columns are in respect to dealing with the facts. You say as follows: "Mr. A. R. Pierce writes on the subject of 'Sampling Large Low-Grade Orebodies,' which was discussed freely in our columns a few months ago. It will be observed that Mr. Pierce is in error on one point; he assumes that the method of determining a sampling factor by comparing hand-samples with mill-tests, as advocated by Mr. Morton Webber, was intended to be applied only to deposits for which the sampling factor would be uniform over large areas, whereas those who have followed this discussion from the beginning will remember that it had its inception in the difficulty of sampling with accuracy deposits whose metal occurrence was essentially erratic."

As I have retained clippings of all the contributions to this important subject, I will proceed to point out that you are not justified in the above statement that I have misunderstood the intent of the valuable contribution to the subject of sampling by Mr. Webber.

Under date of your issue of September 29, 1917, Mr. Webber writes as follows: "The origin of the discussion to which I was asked to contribute, was the discrepancy on the ores of the Alaska Gastineau between the results of mill-tests and the outcome of subsequent full-sized operations." Mr. Webber then goes on to describe the 'combination' method devised by him for the sampling of a large low-grade deposit in Central America. He says: "I will describe a method designed by me for the examination of a large low-grade deposit in Central America." He then goes on to state "the mill-test disclosed a sampling error averaging about 40 cents on an expected mill-head of $3.50. This was roughly 40% of the expected operating profit." It was this 'combination' method that led to the subsequent discussion by E. P. Spaulding, R. Raymond, Charles Bennett, F. F. Sharpless, and others, whose writings I have all before me and none of these gentlemen have inferred that the 'combination' method was intended for or could be applied to deposits where the "metal occurrence was essentially erratic;" I therefore feel that your editorial stating that I have misunderstood the matter is ill considered and uncalled for, and to drive my statement well home I will quote further. Under date of your issue of March 29, 1919, in reply to a criticism by H. R. Sleeman of Australia, Mr. Webber writes as follows: "The combination method of sampling large low-grade deposits was not intended to apply to ordinary size mine examinations. This was clearly pointed out in the original contribution. The method was intended for sampling great low-grade deposits such as the Alaska Gastineau, Alaska Juneau, and others, where a loss of, say, 40 cents per ton between mine-sampling and mill-heads might mean complete financial failure." He also says: "The principles of this 'combination' method will apply to best advantage in mines of fairly uniform mineral characteristics. The greater the variation, the shorter must be the distance between one mill-test and its neighbor, and the reverse."

I therefore must energetically stand by my guns wherein I say, "In the large low-grade deposits for which this 'combination' method was intended, the sampling error, in my opinion, will be found to be generally small or generally great. It will not jump about from place to place as would be expected in a mine of the bonanza type."

In conclusion, while I resent your editorial suggesting that I have broken into print on a subject on which I have not properly familiarized myself in respect to previous writings and premises, I beg to state that I am intensely interested in this important subject and I would much appreciate Mr. Webber or some other authority answering the questions I put which appeared in your issue of September 20, 1919.

A. R. Pierce

Kansas City, September 26.

[We are glad to give space to this criticism. It is possible that the misunderstanding is caused by the fact that Mr. Webber's contribution in the issue of September 29, 1917, to which Mr. Pierce refers, was not the beginning of the discussion on 'Sampling Large Low-Grade Orebodies', but was an enlargement of an earlier contribution by Mr. Webber on the same subject. The entire discussion had its inception in an editorial that appeared in our issue of May 26, 1917, which summarized the various contributions that had been previously received, and asked for further opinions on the best methods of sampling this difficult type of deposit. Messrs. J. H. Mackenzie, D. C. Jackling, and H. C. Perkins were quoted on the practicability of sampling accurately such large low-grade orebodies as those in south-eastern Alaska. In this editorial, as in many of the contributions that it called forth, the difficulties introduced by the erratic occurrence of the gold were considered at length.—Editor.]

The Treaty and the Covenant

By HERBERT HOOVER

*I have been urged by Mr. Taft and others to state at some greater length my views on the Peace Treaty, and I take this occasion to present them to my own townspeople. During the ten months between the Armistice and harvest I acted as the economic director for the Supreme War Council. I was necessarily in intimate contact with the political and economic situation all over Europe. I was not one of the American Peace delegates, but the purpose of my office was to act on behalf of the United States and the Peace Conference in an effort to save life and prevent anarchy while the Peace was negotiated. I therefore had an advantageous position to independently observe the growth of ideas in the Conference and the re-percussions of these ideas through Europe.

I am not of those who have an impatience of honest debate. I believe that the debate on the League of Nations going on in the United States is building the very foundations of the League; it is bringing home to every household in the country the necessity and possibility of providing for our own safety and of providing for the safety of the world as a whole without great armies or navies. Nor do I believe in the criticism of the Senate for not accepting out of hand this document so laboriously evolved by five hundred conflicting minds in Paris. It is a fundamental part of our institutions that the Senate shall scrutinize these matters. Consideration and debate by the Senate is not traitorship.

Nor were those Americans traitors who, in representing us in Paris, fought for every inch of hope that the weak could be protected and the strong curbed, that the United States could itself be protected. If they were traitors to their country it was because they were wrong in assuming that the American people wished an effort made to destroy the seeds of war and thus to secure the growth of liberty.

The treaty finally reached at Paris is by no means perfect. I see no method by which it could have been made perfect when 500 men, representing 23 different nationalities, engaged in its negotiation and agreement had to be unanimous. Difference in national character and in national aspirations could but cause much difference in views. Many of them represented desperate, passionate, or selfish objects, some were dominated by political ideals of the last century, yet the most were actuated by the prayers of the common people, who really fought this war, that it should be the last war. There existed in the world before this Conference scores of those major international wrongs which breed war. Of these the Peace Conference corrected some, but it will take perhaps a hundred years for the men of good will to correct them all. It is often overlooked that this was not a conference to settle wrongs committed by Allies or Neutrals, but by the Enemy only. It was German wrongs that were on the operating table. It would have been beautiful to have all the international wrongs on the table, but this is not a perfect world. As a practical fact, if this had been attempted, the Conference would have broken up in quarrels among the Allies, and Germany would have been handed again the domination of Europe. The old guard in Germany hoped and expected that this would result; up to date at least they have been disappointed. No one could be more disappointed than the American delegation that some great wrongs that were the result of the secret treaties that had been written in times of complete desperation among the original Allies were not eradicted at the Conference. In this the American group was a minority of one, endeavoring to secure that right should be done, in a meeting that required unanimous agreement. There are many other items in the Treaty which men of good will would have liked to see different. Our delegation could have found cause to withdraw from the Conference on many scores. We would have been withdrawing in the face of the Enemy, and Germany, by this division of the Allies, would have been victorious.

Greater things were accomplished by this Conference than by any other in history. The military oligarchies of Germany, Austria, and Turkey were dissolved, and if peace is ratified in time they will be disarmed, and thus a paramount menace to us and the world will be destroyed. The Poles, the Czechs, the Finns, the Croats, the Slovenes and Slovacks, the Baltic States, Armenians, Arabs, have, or will, subject to ratification, secure their liberty. Parcels of French, Italians, Rumanians, Serbians, Greeks, have been re-joined to their mother countries. Representative democratic governments were set up in the liberated and enemy States. Methods were devised by which these peoples would be free from economic domination and by which the Germans and their Allies would be made to pay something on account of the terrible destruction they have wrought, as a lesson to militarism.

The men of Liberal vision at the Conference were steadfast for certain dominant ideals that mark this conference apart from all others. First, that this settlement should remove as many of the immediate causes of war as possible by destroying enemy domination over other races. Second, by establishing the new governments on a democratic basis so that wars should not be made by autocracies for the profit of their class. Third, that there should be established a world council—the League. Here

*An address delivered at the Assembly of Stanford University on October 2.

have endangered the stability of the world for years to come.

Those who formulated the League did not expect that it would furnish an over-night solution to all uncorrected international wrongs or the disruption of these unloosened forces. They did expect that by degrees there would be a definite alignment of opinion in the world that would make these wrongs less and that could in great measure restrain the actual outbreaks of war, that could give the world time to heal its wounds. Even the Sermon on the Mount did not wholly regenerate the world.

We hear the cry that the League obligates that our sons be sent to fight in foreign lands. Yet the very intent and structure of the League is to prevent war. There is no obligation for the United States to engage in military operations or to allow any interference with our internal affairs without the full consent of our representatives in the League. If there is any danger that we should be charged with an obligation to go to war, either direct or implied, without the full consent and approval of Congress, I believe the President will be the first to agree to any interpretation that this cannot be. The French government so far takes this view that it has requested from us a separate military guaranty for themselves.

The League is founded expressly in the attempt to secure the pacific settlement of these questions without military force. To me, every line of it is the complete negation of militarism. During the course of negotiations in Paris one fact stood out with regard to the League. Its opposition there arose entirely from the representatives of the old militaristic regimes, and from the reactionaries of the world in general. They saw in it truly the undermining of militarism. They had the vision to see and even to state openly that it would mean the ultimate abandonment of military force in the world, for they, as of old, contend that without military exercise there is no hope of the maintenance of human efficiency or control of the masses. What they foresaw has already happened in a great military nation like the British, where the population, broken under a load of taxation, is responding quickly to the new possibility of international safety without the burden of gigantic naval armament. The reactionaries saw that under the hope for the protection of the League of Nations there would be a growing opposition to the burden of armament from all those who labor with hand and mind. It is the workers of the world who pay the price of war, not alone in the support of arms but in blood and in the support to tyranny which armies mean in peace.

All wars have hitherto been settled on the basis of trying to create a balance of military strength by intriguing peoples into various groups of equal military weight—the balance of power. It would have been impossible to give liberty to the score of new nations of militarily weak yet liberty-loving people without the League to safeguard them from invasion. Beyond this, every attempt to set up this balance hitherto has ultimately crashed in war, for its essence is militarism. The creation of the League brought new hopes into the Peace, and if the League fails these new liberated nations must

fall, for the world must re-adjust itself into the balance of power and great wars will re-open at once in this re-alignment. In a recent visit to many of the capitals of the new States, the first anxious question of their officials was, "Will America ratify the League?" Their invariable answer was that without it their only course was the hopeless effort to arm themselves against stronger neighbors; to do it in the midst of misery; to endeavor to set up groups and military alliances with all the old treadmill of oppression of arms and ultimate war.

There are many elements in Europe that wish to see the treaty break down and the League of Nations disappear. For instance, during the last five months our Allies have been growing weaker from a military point of view, due to the necessity of demobilizing their armies, while at the same time the reactionary group in Germany has been growing in strength through the re-creation of hopes of yet securing a division of the Allies. At the time I left Europe, a month ago, German militarism had already re-established itself as a well-disciplined well-officered army of at least 400,000 men, largely congregated on the Polish frontier and even defying the government at Berlin. Under the alarm of this danger, the Poles, in the midst of the greatest economic misery that a nation ever knew, have been trying to create an army of 500,000 men for their protection from the Germans on one side and the Bolsheviki on the other. If the treaty is ratified the German army will be reduced to 200,000 men and dispersed over Germany, and their extra armament destroyed. The failure of the treaty means the invasion of the Polish state. This is only one of the powder-magazines in Europe which cannot be destroyed until their treaty is ratified, and during every day of delay more explosives are poured into them.

For good or ill, the entire treaty was constructed around this central theme of a League of Nations to prevent war. A score of provisions in the treaty and outside the covenant necessitate its erection. To avoid causes of war, the League has been made the trustee to secure outlets to the sea, to secure free ports to inland peoples, to settle deferred disputes which could not otherwise hope for solution without dangerous friction. The treaties themselves cannot be carried out without the League. If the League falls the treaties also fall.

The boundaries of these new States cannot precisely include all their own nationals, for the borders are lined with racial islands and friction. Peace and a moderating council are required for re-adjustments. Their outlets to sea by rail, canal, and river are through other States; their whole political and economic situation demands peace for the growth of order and the prevention of anarchy. If the balance of power has to supplant the League of Nations we will have torn asunder the only hope that Europe will not break into further wars of races, classes, and groups that will take her civilization back to the Middle Ages. I am convinced that if we attempt now to revise the treaty we shall tread a road through European chaos. Even if we managed to keep our soldiers out of it, we will not escape fearful economic losses.

If the League is to break down, we must at once prepare to fight. Few people seem to realize the desperation to which Europe has been reduced. During the coming winter some of them will look with longing eyes on this rich fat nation, possessing great surpluses of every human necessity, while they endure inevitable hunger and cold. At the same time, the energy of our population is supplanting them in places where their merchants expect to market their goods and operate their ships. Others of them will be plunged into war with their neighbors, and we have already experienced the difficulty of maintaining neutrality with self-respect and safety. We cannot fiddle while Rome burns.

The Allies may themselves ratify this treaty without us, and thus assemble a Council of Nations of their own in an endeavor to solve the problem of Europe. It would be a Council of Europe, and in the midst of these terrible times, with the debts they owe to us, the material they must have from us or starve, I would rather be represented therein lest it become a League of Europe against the Western Hemisphere.

It is true we are not loved by certain classes of people, some of them among our former allies. It is untrue, however, to say that the masses of any nation now hate us. It is still more untrue to say that the newly liberated peoples look to us with other than the conviction that our moral leadership is their only hope. We are not loved by any military class, whether in the allied or enemy countries. Our whole object has been to destroy their calling, to undermine their class. The great masses of burdened working people, however, look for us to support this one hope of relief from domination, from burdens and misery of arms and war.

Neither the gospel of hate nor the gospel of unpreparedness is the road to peace. The true road lies in every effort to remove the causes of war, not in tearing down such structure of peace as we have, nor in blindness to present dangers.

Those who think we can isolate ourselves seem to ignore the fact that modern communication has shortened our distance from our neighbors from a month to an hour. A vast amount of our civilization and the daily improvements of life that come to our people are the products of the ideas and intelligence and labor of our neighbors. If we believe we can see our neighbors return to a thirty years' war through the breakdown of this treaty and we still maintain our progress, it is the egotism of insanity. We are an overseas people and we are dependent upon Europe for markets for the surplus products of our farmers and laborers. Without order in Europe we will at best have business depression, unemployment, and all their burden of troubles. With renewed disorganization in Europe, social diseases and anarchy thrive, and we are infected with every social wind of Europe. We are forced to interest ourselves in the welfare of the world if we are to thrive. There is no American who has spent the last ten months in Europe who does not pray that we should get out of entanglement in the sordid selfishness, the passions, the misery of it. But our expansion overseas has entangled us for

peace is at stake, and I stand for an honest attempt to join with Europe in a better spirit to prevent these entanglements from involving us in war. We are not dealing with perfection, we are dealing with the lesser of evils. These are reasons of interest.

There are also reasons of idealism. True national interest lies along the path of practical ideals, and there are ideals in Europe. During the last 150 years, a far larger proportion of our citizens have grown far ahead of those of Europe in outlook on life, in disinterested sense of justice, in sympathy with the down-trodden. It was with the hope of ending war that we went into it, and to fix it in international law that dominated our representatives in the Peace Conference. We have expended the lives of our sons and an enormous portion of our wealth, hoping to see these ends. For us to refuse to enter into a joint attempt with the well-thinking sections of a large part of the world to establish a continuing moral conscience against war is the utmost folly in our own interest.

We have been the centre and inspiration of democracy for a hundred years. We have given sympathy and encouragement to every aspiration for self-government for all this time. We have from our experience in its blessings believed it made for peace and well-being. We enjoy from it the highest standard of living in the world. We went to Europe with our best blood and our treasures and fought the attempt to impose autocracy on the world. We won. We imposed democracy all over Europe. We set up a score of new democracies—and they are many of them peoples of our own blood—the Baltic, Polish, and Slav races. Are we to refuse our counsels to these peoples now struggling to realize our own ideals? Curious as it may seem, this also embraces Germany itself. That sincerely democratic group which today controls Germany is losing ground before the old reactionary group who employ the hope of the failure of the league to fan the renewed hope of domination.

I am one of those who hold that this war would never have happened if the nations of Europe had accepted the invitation of Sir Edward Gray to a conference of civilians in July 1914. I believe that if the intelligence of the world can be aggregated around a table, the pressures from the responsibility of these men for the possible enormous loss of life and the fabulous amount of human misery created by their failure to prevent war are such that no body of decent men in these times can fail to secure some sort of solution short of war. We have now seen the most terrible five years of history because the statesmanships of Europe refused to come into a room to discuss the welfare of humanity. From this mighty political, social, and economic upheaval there are a host of outstanding problems which can breed war at any minute. The Liberal world is asking us to come into a Council to find solution for these things. It is not asking for sacrifices of its sons for our economic and moral weight, our idealism and our disinterested sense of justice. Are we willing to take the responsibility that rests on the souls of those men in Europe who refused this invitation in 1914?

Tin Mining in Malaya

Much interesting information is contained in the annual report of the Chief Secretary of the Federated Malay States for 1918, regarding tin mining, which is second in importance only to the rubber industry. British Malaya occupies the first place in the world in the supply of both of these important commodities, with Singapore as the world's greatest market.

In his report for the year 1918, the Chief Secretary says: The revenue, excluding special war taxes, derived from mining amounted to $7,931,715, an increase of $2,312,087. This was due to the high price of tin for a great portion of the year. The total amount of tin exported during 1918 was 37,370 long tons, as compared with 39,833 long tons in 1917. The average yearly export for the past five years was 43,376 tons. An appeal was made to the mining community to make every endeavor to increase the output of tin in view of the needs of the Allies in connection with the War, but the output decreased. It has frequently happened before that the result of a high price for the metal has been a decrease in the output. The reasons are simple. The mining laborer finds that he can earn as much as he wants with less exertion, and the careful mine-owner finds that he can profitably work low-grade ore which it would not pay him to work when the price of tin is low. The richer ground is, therefore, held over. One large mine, which is capable of maintaining a steady output, reduced the output from 2616 tons in 1917 to 1878 tons in 1918, and doubtless the main reason for this large reduction is that low-grade ground was being worked. Possibly, however, there were other reasons which contributed to this, although to a less degree.

With the sudden termination of the War in November the need for an increased output disappeared and stocks of tin were far in excess of the world's requirements. There was considerable feeling among the mining community when this second crisis in 4½ years came upon them. The first crisis could not have been foreseen, but it should have been realized that there must be an end of the War, though the exact date could not be foretold. The market for tin was closed and it became necessary for the Government again to purchase the output. At the time of writing there is still no market for tin. America has prohibited the import of Eastern tin and the Government is still buying.

The average price of tin in 1918 was $85.52 per picul (133⅓ pounds) of Straits refined tin. The highest price was $103.61 on August 3, and the lowest $66.75 on January 4; the average price in 1917 was $61.74. The Imperial government assumed control over tin and appointed buying agents in August when the price was about its highest and rapidly reduced the price until it reached $67 per picul. The Imperial government ceased buying in December. It was at $67 that the local Government decided to buy, and this price was maintained till after the Chinese New Year (February 1), when the Government buying price was reduced to $65.86, and eventually to $56.78, at which price it now remains.

The Relation of Health to Work

By THOMAS DARLINGTON

"We have come a long way in the last 40 years. I go back to when I commenced the practice of medicine, and I am in my 40th year of practice. The annual death-rate in this city when I had an office down in West 30th St. was 35 per thousand, nearly 36. Now, it is only a little over 13, because of discoveries in medicine, just as wonderful in medicine and prevention of disease as all the other discoveries that have come along in the last 50 years—the great wonders in electricity, means of locomotion, everything that we have today. Likewise medicine has opened a new field, particularly in prevention of disease. We have commenced to consider man in a different light. We know and have known for a long time that it pays to take care of an accident. Compensation laws have been enacted and we know that it costs something every time a man loses his finger. It used to be, even 10 years ago, that in some of the steel plants when men became injured the wound would become septic in fully 50% of the cases, 500 out of a thousand. Today in various steel plants, such as the U. S. Steel Corporation, Carnegie, Youngstown Sheet & Tube, only one in a thousand becomes septic, and in the Bethlehem Steel very much less than that. In the big plant at South Bethlehem in four years of accidents, taking every little thing into consideration, every little scratch, 50 or 60 cases a day, there have been only two cases of septicæmia.

Now we have come to another time when we find it pays to take care of the human machine to even a greater degree and in other ways. The deaths in the army both from disease and those killed in battle are nothing compared to those who become ill and die in industry. Man is a machine. How is he usually cared for? Let me give you an illustration. Here is a man who has made his pile. He goes home and says, "Wife, we have made a million. I have sold out the plant, we are never going to work any more, you and I, we are going to get a Rolls-Royce and we are going to motor out to California. We are going to run the motor slowly across the country and will see everything, and we are going to take our ease the rest of our life; but you know, of course, we will come to places where we will find it very difficult to get water and in other places we may not always get oil, especially when we cross the desert, so I'll tell you what we will do. We will take the machine out next week and take it out two weeks without water and we will take it out two weeks without any oil and we will make it hard as nails." Rot, isn't it? That is something like the care that a soldier in the army is supposed to be given. I have just come out of the army and I know something about it, having the contagious diseases of fifty thousand men to look after, and it is the same care that is often given to men in industry. We treat them just like that man treated his machine. We think that hardship hardens a man and we look at the brown faces of the men that have come from abroad and say they are "hard as nails," but I am thinking of all those that went down, of many deaths, for which there seemed to me to be no necessity. Given a well man and you have absolute control of him. Why should he get ill?

From my standpoint, efficiency depends primarily on health. The German philosopher, Münsterberg, said it depends on a man's psychology, but what does psychology depend upon? Flow of blood to the brain, and flow of blood to the brain varies with all kinds of things, with the weather, the pressure of the barometer. Suppose your liver is out of order. Don't things seem to have a green and yellow hue? If you don't think psychology changes, let a man try six of these [indicating a cocktail] and see whether his psychology changes. Instead of feeling poor, you own the world. Psychology depends on health. Efficiency depends on health, and it pays to take care of a workman.

As a matter of fact, illness in industry already has an effect on operating cost that is far from being realized. Whenever a man is absent from his work because of illness, it is usually necessary to have someone else take his place. The substitute, as a rule, is a less efficient worker; he makes a smaller output for the day's wages, he spoils more raw material, he requires more supervision from the foreman, who is thus distracted from more important work, while procuring and sending the substitute to the work needed involves a cost and usually a delay in the operations. I have seen a business fail because it depended on one man, the superintendent, and he got typhoid fever and there wasn't anybody to run the business.

Efficiency depends on health, and health depends on three things: the care that a man gives himself, the care that industry gives him, and the making and enforcing of health laws, city, state, and national. What can people do for themselves? Before I take up that question, I have been told that some of the members here are interested particularly in the question of fatigue. I happen to be chairman of the Committee of Fatigue of the Council of National Defense and I want to talk to you about how people get tired. Fatigue means much to a worker. If a person catches cold it is when he's tired; if you catch an infectious disease it is when you're tired. Fatigue lessens resistance to disease. Fatigue is the one great thing in this world that we want to avoid. What makes people tired? Work? No. Very seldom. It

*Abstracted from an address delivered before the Mining and Metallurgical Society of America. For many years Dr. Darlington was Commissioner of Health in New York.

isn't work. Child will make you tired. It makes every cell in the body work fast. A great many things make fatigue, but seldom work. That is a different idea from that which most workmen have.

I once ran for a political office in this town—I was defeated—Borough President. While I was campaigning at that time, standing on a soap-box, I heard a man say, "My friends, the time is coming"—this was down on the East Side—"the time is coming when we are going to have a three-hour day." Think of it, a three-hour day, because they believe, like all the Bolsheviki, that work is the cause of the evils. That isn't true. How do people get tired? Now, to know that you have got to understand a little physiology. We must understand the body. Every part of the body is in motion all the time. When any part isn't in motion in the body it is dead. You are manufacturing heat, you are getting energy all the time. That comes from your food. Food goes into the body, is taken up and stored in the body, and you have it to use. It is then burned up by means of the oxygen which you breathe. All the time in the body there is a breaking-down process, all the time there is a building-up process.

I move my arm like this [illustrating by bringing the forearm up]. What has happened? The will sent an impulse into this muscle, the biceps, that is attached to the arm. It contracts. As the muscle contracts up goes the arm, but I have used up some energy in this muscle. Energy comes from something. What is it? Something in the muscle—$C_6H_{12}O_6$. What is that? Dextrose. The $C_6H_{12}O_6$ becomes $2(C_3H_6O_3)$. What is that? Lactic acid. If I keep on doing that pretty soon that muscle gets sour—tired. What becomes of the lactic acid? Burns with the oxygen, finally comes out CO_2 and H_2O, and goes out through the lungs and the kidneys. Very simple, isn't it?

First we use up all the sugar. All the starches go into sugar. We store that in the liver. That is the coal-bin. Then when you have used up all the sugar, you use up the fat. That is much more complicated. After you use the fat in the muscle you use the muscle itself. How do people get tired? We will suppose they have no sugar in the muscle. Well, then, you haven't anything to work with, have you? Then you are tired. It is a great deal like the energy developed in a boiler. You have got to have the coal. What a difference whether you get slaty coal or whether you get Pocahontas. A wonderful difference isn't there! The next thing necessary is a draft. If there is no draft it doesn't burn well. And the next thing is to get rid of the ashes of waste.

Energy depends first upon the food you eat, the kind of food, whether the system can use it or not, whether you digest it and store it away. Next upon the oxygen which is carried by the red blood corpuscles, the haemoglobin in the blood. The first thing then in the question of fatigue depends upon the character of the food that people eat. Very few people understand that, and so far as the workmen are concerned few of them or their wives know anything about feeding the man, and any old thing goes in the lunch basket. One day I opened 250 lunch-boxes in a Carnegie steel plant. The first bucket opened contained a whole boiled cabbage. How much $C_6H_{12}O_6$ did he get to use in the muscle, how much energy could he develop from that cabbage? It was good for one thing. Perhaps I will tell you a little about that later. The next man had nothing but cake and honey. He got all the $C_6H_{12}O_6$, but what did he get to make up for the loss of protein and muscle? Nothing, and he was thin.

But it is not alone a question of the kind of food that he gets. Does the man digest that food? Was it mingled with bacteria in the mouth and fermented in the stomach? Did the sugar split up into acids in the stomach before it got into the muscle? Don't you see that energy is the converse of fatigue and fatigue the converse of energy? Energy depends first upon food and its digestion, its absorption and utilization, and next how are you going to burn it? It is burned with the oxygen. Take a drop of blood from a man and examine it under the microscope and we find that he has a 5,000,000 blood count. Yes, that is a good healthy man. It is up to normal. The next man we take we find he has 2,500,000 blood count. Doesn't it take twice as rapid a circulation of the 2,500,000 to carry the hæmoglobin as the man with the 5,000,000? Yes, twice as fast the blood has to work because he has anæmia. What does anæmia come from? Dark unventilated rooms, infectious disease, poor food, lack of movement from the bowels, bacteria in the mouth, in the tonsils.

Next get rid of the ashes of waste, and how do we do it? The waste is all through the body.

There was an old professor in Turin who watched quails migrating across the Mediterranean; some of these he caught that were very tired after they flew across the ocean and he picked them up. They were too tired to prevent his picking them up. He took them home. Next year he caught some more and he took the tired quails and took the blood out of them and put some of this blood into the quails that weren't tired that he caught the year before and it made them tired.

How do you get rid of this waste? Well, the blood takes it up and takes it away. If a person drinks a great deal of water that helps. If you have a shower-bath you drive the blood inside and then it returns to the surface again and that helps and soon you get rid of all fatigue and the waste goes out through the kidneys. But other waste produces fatigue. Sometimes a person does not have a regular movement from the bowels, because instead of having modern water-closets you find places that you couldn't dignify as even privies—simply an old bar. One man made them as bad as he could. Why? He didn't want the men to linger there. Well, he lost lots of money, and I will show you how. In fermentation we have bacteria in the bowels all the time. In fermentation, particularly of protein food, you develop certain poisons. These poisons are known as indol, skatol, mercaptan, and certain phenols. The last develop particularly from eggs and milk. The most common poison found is indol. That is absorbed and becomes a sulphate in the system and that is known as indican. When you have a urine ex-

autuation you see so much sugar, so much albumen, and so much indican. The sulphate of indol is indican.

To show you how it works and how a lack of movement of the bowels produces fatigue, a man gets up in the morning and he hurries, he hasn't quite time to have a movement at that moment. He goes to work, doesn't go outside, he has got a lot to do, and the little amount of liquid material around the movement in the lower part of the bowels is absorbed and the desire to have a movement passes off. What has happened? Let's see for a minute. [Draws sketch on blackboard.] This is a stand. This is a cylinder which is smoked. Here is a short arm fixed. Here is a long arm on a pivot. We put in here a muscle, the back of a frog's leg, called the gastrocnemius muscle. We now put an interrupted current in here and the smoked cylinder is timed to revolve as you put an interrupted current through. The muscle contracts. That pulls up this arm so that on the cylinder you get a record. We take a muscle and into this muscle we put a few drops of salt and water with a hypodermic syringe and take the record. Now, if we can get two muscles from the back of a frog's leg, get them out just exactly the same, and we want to see the difference in the muscles we take the first one with an injection of a little salt and water and this is the record that we get of that muscle [illustrates on blackboard], taking about every fifth mark and finally the muscle stops contracting; it won't go any longer; it is all used up; it is dead. Now, we will take a little indol from a movement, a fraction of a drop, and this time put that in with the salt and water and inject that into the other muscle. What do we get? The muscle stops work in a little more than one-third of the time. That is the man's lifting capacity. The man who hasn't had a movement of his bowels in the morning, absorbs that material through his system. The man has only about a little more than one-third the efficiency of the other man so far as his actual muscular capacity is concerned. If the one man is worth $6 a day, this man is worth $2.30. That is putting a movement of the bowels into dollars and cents.

Don't you see that fatigue doesn't depend entirely upon the amount of work that a man does? It depends, first, upon the energy he receives from his food and, second, upon the quality of blood that is carrying the oxygen to the tissues. So much so that when he gets up in the morning he puts up his hands to Heaven and says, "Thank God, there is another day to work." He works well because he has the energy, and he loves it.

Once when I explained this to some of the steel people, I said that if I was building a steel-mill or any other kind of a mill the first thing I would do would be to build a marble water-closet so as to get everybody to go in. So one of the steel-men did that and all the Italians went in there and ate their lunch. You see, there are some other points which you must consider besides the mere health of the men. Once in a while there comes a slip.

About the efficiency of the man himself, don't you see it goes into every phase of that man's life?

Before the War we were just approaching these things. Back in the Old Testament it tells about the Jews when Nebuchadnezzar was outside the walls and had his great army there and his banners and they all gave up everything they were doing that they didn't think was just right. And some said "What about these slaves of ours?" and they freed them all. But one day they saw the banners of Nebuchadnezzar in the early morning disappearing in the far distance and when the danger was past they said, "Where are those slaves of ours?" and again they made them slaves.

While the War was on it was our winter and the leaves were off the trees and we could see a long distance. We must continue to see that long distance. We can't go back to our ante-bellum days. We have got to go forward. We have had a vision of what is right and we can no longer go back, but must do everything that we can for those who are ignorant and less favored by birth in station of life.

Let us now take up one or two other things. I said that a man's efficiency depends upon what he can do for himself. Now, among the many things of personal hygiene besides the question of taking baths, care of the eye, the ear, and the nose, and everything else of that kind, and regulation of a man's meals, there are simple things like the brushing of teeth. How many workmen in the factory brush their teeth every day? To be efficient men they must brush their teeth seven times a day. Do you suppose any of your workmen know that? Not one of them. Why must they do it? Let's just look at it. It is a simple thing. The manufacturer is interested in it because of his output. If I had a factory I'd make every man a present of a tooth-brush. It was done in the army. I helped to take care of 50,000 men and had to talk to them. Pneumonia killed some of them because they didn't brush their teeth. What did they do with the tooth-brush? Used it around the edge of the shoes to get the mud out. What is the first thing about the teeth? Well, we need them for enunciation. In the army it was absolutely necessary that orders should be distinct. The chewing of food means a lot in energy. Still, that means little compared with some of the other things. Personal appearance is one. We all like beauty. You cannot imagine a beautiful woman without any teeth. But let that go. In the mouth are 48 varieties of bacteria. If you chew the food without brushing the teeth you swallow those bacteria and the food ferments in the stomach and often it passes the quarantine of the stomach and goes down to the bowels.

There was an old doctor in 1822 who lived on the shores of Lake Champlain -Dr. Beaumont. He had a patient that was brought to him by the name of Alexis St. Martin, who had a hole shot in his stomach, and the doctor used to put food in this patient's stomach and watch it digest. He found that gastric juice would keep indefinitely under ordinary circumstances but that if he swallowed much saliva it spoiled quickly. Why? Because the saliva was full of bacteria. Do you know that in the army in the grippe epidemic very few if any died from grippe? They all died from pneumonia. Why? There

and four types of pneumonia germs. Nearly all died of the pearl type. That is a mouth bacteria. They got the grippe and then the pneumonia bacteria that inhabited their mouth and grew there went into the lungs and killed them. If they had all brushed their teeth regularly, many of them would have lived. Many, very many of the 600,000 people that died in the United States would be alive today if they had brushed their teeth in that epidemic. But that is very little compared with the other thing. A tooth dies, but you do not always know it. At the root of that tooth there comes a small abscess. From this bacteria and the toxin are absorbed in the system. Just the same as in the tonsils. The tonsils and the teeth make over 90% of our infectious diseases. The poison may go into the heart, producing vegetation of the valve; or go into the kidneys, and make Bright's disease; or go to the bladder and make inflammation of the gall-bladder. Nearly all rheumatism comes from bad teeth.

Do your workmen know that anaemia, the loss of the red blood-corpuscles that carry the oxygen to the tissues, is often due to abscesses at the roots of the teeth or old roots in the mouth? Have you got a dentist in every factory pulling out these old roots? No. The first thing I did at Hog Island, where I was consulting surgeon, was to put three dentists there. They said a great deal of money was spent there. Thank God, I had an opportunity to demonstrate some things that had never been done before.

Deaths from shock and hemorrhage! Men die in a few minutes from shock, but if you have blood to inject into them right away you often may save them. We hired three men, and gave them $1200 a year apiece and fattened them up and kept them raking leaves, and when a man got injured we took some blood from them and injected it into the injured person. We saved three men worth $5000 each according to the Pennsylvania Compensation Law the first month. $15,000 against $3600 in the first month!

How about washing of hands? It is from dirty hands that bacteria get into the mouth. What does the surgeon do? Simply wash his hands? No, he puts on rubber gloves, even after he has put his hands into absolute alcohol with bi-chloride. I remember when I was a boy going to college George Francis Train sat in the park. It was back in 1874 and I remember asking old Train, "Why won't you shake hands with anybody?" and he said, "I don't know where a man's hand has been last." There is something in it. Take the case of 'Typhoid Mary'. How did she give typhoid to 28 different families? Because she had typhoid germs on her hands. Very little, but it gave disease. Does every workman wash his hands before he eats lunch? There is something else that workmen generally do not know. That man that was talking about the three-hour day, did he know that Solomon says "By the sweat of thy brow thou shalt eat thy bread?" The man that doesn't do it doesn't live as long as the worker. To live long you have got to work. Work leads to longevity. The rich man of today, what does he do? Does he do like the man in the Bible who said, "Now, soul, we will enjoy ourselves and eat, drink, and be merry?" The rich man today builds an 18-hole golf-course and works like the devil to keep his health. Work doesn't hurt anybody.

That is what we have got to teach the workman.

We have in the neck a gland called the thyroid. We have more important ones over the top of the kidneys, little thin glands called the adrenals. These are like the governor on an engine. They control our circulation. If you lose those glands you die. These adrenals throw out a powerful drug. I know of two men at the front where a big shell burst and adrenalin was thrown out so that every hair stood on end for a week. A grouch, grief, anger, or worry are ruinous to the body. They cause adrenalin to be thrown out. But joy, love, laughter prolongs life. What does that mean? It means that we must teach the employee cheerfulness; that every man shall find in his daily work his greatest happiness. Just as God Almighty found happiness in the creation of the earth, we, made in His image, must find our happiness in our daily work, no matter what that work is.

I have simply given you an illustration of the care of the human machine. I have put before you the money side of the question. We have to do that with a corporation. In all the big plants of the steel industry throughout the United States many million dollars have been spent along these lines, in education of workmen, teaching them to wash their hands, to take showers, to do all these different things, and providing facilities for them and their families. Wonderful work! The steel industry today leads the world as a great industry. I am not saying that to the disparagement of others as far as welfare work is concerned, but it is the largest industry.

We now come to another side of it, and that is this: Cain's answer by the Garden of Eden was, "Am I my brother's keeper?" The Bolshevists and the Socialists have used that for a great while, this cry of the brotherhood of man, which means nothing to that class. When I was in the Department of Health we had 187 laws. They all meant one law. How can you translate them into one law? The man that loves his neighbor won't spit on the sidewalk, he won't sell his neighbor bad food, he won't let smoke come out of his chimneys, he won't let his child with contagious disease run around and spread the disease. That is the thing that we must teach workmen, the love of their neighbors. It is a great thing to relieve suffering. It is a far greater thing to relieve penury and crime, so we can say with Abou ben Adhem, "Write me as one who loves his fellow men."

AS A DOMESTIC FUEL most lignites are unsatisfactory on account of their comparatively high sulphur content, and in Canada they have proved an unsuitable substitute for anthracite, for which many household stoves are properly designed. In the same country the use of lignite for firing locomotives has been forbidden by the railway commission on account of its property of emitting dangerous sparks. Experiments so far made with the object of briquetting lignite have not been successful.

The Federal Taxation of Mines—II

Methods of Mine Valuation

By L. C. GRATON

As already pointed out,* the latest revenue law provides three ways of arriving at the value of mining property, namely:

1. The cost, if purchased on March 1, 1913, or later.

2. The market-value as of March 1, 1913, if purchased earlier.

3. Re-valuation in either of the other cases, provided since March 1, 1913, or since purchase subsequent to that date, new discovery in unproved ground results in a value disproportionate to the value prior to discovery.

Most of these methods are methods of indirection. The method or methods which I trust may be followed in the present attempt to apply the tax laws to the mines should be methods as direct as possible, that is, engineering methods. Stock-market quotations may, under some circumstances, afford a rough check on valuations arrived at by more direct and reliable methods, but in themselves can ordinarily be given little weight.

Mines, since they are of diminishing value in proportion as they yield return, have to be valued by estimating the total earnings and the total life, and from these working back to such a valuation as will afford a demanded annual rate to cover profit and risk and will be itself returned at the end of the estimated life by a sinking-fund accumulated from annual depletion increments. This present-value-of-eventual-earnings method is, so far as I am aware, the only definite method of mine valuation expounded in text-books on mining or in treatises on mining investments. Of necessity, this present-value method of mine valuation must be the corner-stone on which the work of the Revenue Bureau must build. Mines vary so greatly in character and conditions that no single basis of valuation can be applied indiscriminately to all without grave error in the case of many. Clearly, either each mine must be considered in unlimited individual detail, or else classes must be established into which mines of essentially similar character and circumstances shall be grouped and these classes handled as if individuals themselves. The latter scheme, that of grouping into classes, is likely to afford the best practical solution because the single-mine method would require a degree of detail and an amount of time that would render the problem almost hopeless.

Unquestionably the fairest and most defensible method of mine valuation is the present-value method, provided the essential factors that enter into the computation are reasonably well known or can be arrived at with fair reliability. Most coal mines, many iron mines, the porphyry copper mines, and perhaps a few others can be valued pretty directly and satisfactorily by this method, because more of the necessary information is available for them than for any others. For them, any other method is likely to be less reliable and less fair. Obviously, also, valuations so determined for such mines will be the most reliable group of valuations of all that will be established. Therefore, it seems to me logical to value those mines by the present-value method, to which it will directly apply, in order to establish certain standards or yard sticks by which to determine valuation of those mines for which less and less of the necessary data are available.

Let me illustrate why this method of comparing with a standard is desirable and permit me, if you please, to use by way of illustration both here and hereafter examples from the copper industry with which I am most familiar. A given porphyry copper deposit may be producing 100,000,000 lb. per year at a gross profit of 6c. per pound and may have an indicated life at that rate of 30 years and a past history of successful production behind it of 8 or 10 years. A limestone formation may likewise be producing 100,000,000 lb. of copper per year at the same gross profit of 6c. per pound; it may have a successful producing record behind it of 30 or 40 years, yet have actually developed ahead only, say, 3 years' ore supply. Is the porphyry mine to be valued on the 30-year life basis and the mine in limestone to be valued on the 3-year life basis? Obviously not. How, then, is the limestone deposit to be valued? Will not its true value be best arrived at by applying certain properly-determined factors to the value indicated for the porphyry mine—factors that will take into account its greater risk in ore continuance or life persistence and that will make needed provision for such other changes or differences as past experience has shown are likely to arise as between limestone mines on one hand and porphyry mines on the other?

If this conclusion is sound, it follows that the present-value method will be the keystone of the valuation section's work and that a series of modifying factors must be established which will bring other mines into proper balance with those to which the present-value method can be applied directly and without modification. Right here, in my opinion, lies the keynote and crux of the entire valuation job. If a series of factors or indexes can be established that are practical, effective, and fair, the problem is going to be simplified immensely. Let the mining companies contribute, through their technical staffs, all the help that they possibly can.

*In the preceding article, appearing in our issue of October 11.

If the present-value method is to be extended to the great majority of cases of valuation, as just indicated, there arises a multiplied obligation that it be applied in an absolutely logical and proper way, and with all reasonable exactness. Inasmuch as the method, at its very starting point, relies on factors, such as tonnage and yield of ores, which are necessarily but estimates and approximations at best, it might seem natural to conclude that all subsequent steps in the process could, with entire permissibility, be of only corresponding accuracy —that, indeed, any attempt to introduce greater refinements than those imposed at the outset would be futile and absurd. That is the conventional theory of error. Perhaps it is justifiable and sound when the object is the attainment of a proper *average*. For the probability, or so-called law, of averages will ordinarily balance individual low results with corresponding high ones. But in dealing with this tax problem, we cannot be content with a fair *average*. We cannot satisfy A's complaint by proving to him that "B was let off correspondingly easy, so the thing evens up after all." The essential and reasonable accuracy of *each* individual result is important.

While it is, of course, unnecessary to defend the present-value method of mine valuation, it may nevertheless be well, in view of the responsibility which it may have to bear, to analyze with care what its consequences will be if used in the taxation program, and to indicate some of the considerations that in my personal opinion ought to be given appropriate attention in such an application.

The valuation engineers of the Revenue Bureau, as I understand it, are to answer the question of valuation that is comprehended in the imaginary situation of a prospective buyer, competent to measure mine-values and actuated by the hope of profit to be derived from mine operation, making an offer for a mine to the owner who is likewise competent to measure mine-values and who is under no obligation to sell except such obligation as arises from his belief that the offer made is advantageous to him.

Now the first question that a prospective buyer would want to determine is the security of his capital. He realizes that mining is a hazardous and unensurable business. Therefore, he demands a higher return on his money than he could obtain if he invested it in an ordinary manufacturing business or in a good mortgage. Since the interest rate must thus include both actual profit and compensation for risk, it is clear that the determination of the rate cannot be based on the mining industry in general as compared with other industries when, as a matter of fact, the degree of hazard varies greatly among different classes of mines; clearly enough different rates must be established for different classes. On these determinations as well as of proper interest to be credited on the sinking funds, much thought may well be expended.

Let its assume that our prospective buyer concludes in a given case under consideration that he should have 10% on his money each year, in addition to a depletion installment calculated eventually to return his capital sum. As a matter of fact, regardless of whether he spends it outright or invests it in something else or places it, as theoretically intended, in a sinking fund for the positive redemption of capital, his annual depletion installment, if actually received, continually reduces his stake remaining invested in the risky mining enterprise; yet if everything goes well and his original assumptions on the basis of which the valuation was reached prove to be justified, he will be receiving a 10% return on his entire initial capital through the last year when only a small fraction of that capital is invested in the 10% risk and the major part has been used in some other way. In reality, therefore, he receives on the average distinctly more than 10% on the capital that is at risk.

Since the money still in the enterprise derives greater and greater interest return with time, it could, therefore, afford to carry greater risk during the late than in the early period of the investment. Clearly enough, in a going mine, purchased on the basis of proved and prospective ore, the early years would indeed involve less risk, while, as viewed from the beginning, the later years, necessarily relying on ore less positively assured, would entail greater uncertainty and hazard. The method and the facts thus appear to coincide in direction, and although it may be doubted if the risk mounts at the very end at so rapid a rate as the percentage of return is found to do, or if, on the other hand, the risk of the late middle years is sufficiently covered, it nevertheless seems likely that no more accurate coincidence can be established save by complex formulas which would be quite unjustified. Acceptance of the flat rate has behind it, furthermore, the support of accepted custom. Still another advantage is that, because of the rapidly increasing spread in the later years of life between, say, an 8%, a 10%, and a 12% flat rate of return, justification is afforded for employing, in the computations of present value, rates of interest that do not differ very greatly and yet make provision for a wide range of risk, as for example, a porphyry copper mine and a pockety silver mine.

Another phase of the present-value method which appears not to have been clearly set forth in any of the discussions thus far devoted to this subject, is that all the assumptions on which this method has been based and all the tables that have been printed as aids in applying it arise from the idea of equal annuities, and imply, in fact, that a given property will mine a fixed tonnage of constant average grade of ore throughout its history. All the computations as to life and all the interest factors involved rest on such assumption. As a matter of fact, these assumptions may apply to certain classes of property. They probably do pretty well apply to operations upon a given seam of coal tributary to a developed industrial district. It was to such a condition, I believe, that this fundamental method of valuation was first applied, namely, the English collieries. But the assumptions of constant grade of ore and a fixed tonnage per year surely do not aply to many other mines in which this method could otherwise be advantageously used. Many mines, like the porphyry coppers, which have great reserves of ore established by exploration; will through

choice, and must indeed, of necessity, work richer ores during their early years and depend upon leaner and leaner ores as their life progresses. This will tend to bring realization of eventual earnings into the interest market at an earlier date and will increase the present value of the property. Likewise, such mines possessing enormous ore-reserves are likely to continue in future as they have done in the past to increase their scale of operations and their rate of output so that the actual life of the mine will be shorter than is indicated by any present rate of exhaustion.

Perhaps some justification should be given for the conclusions that have just been stated. First, as to the hypothesis of declining grade of ore with time. Almost every influence combines to cause mining of a great deposit to begin on about the richest ore it contains. Some of these influences are:

(a) Most deposits of the class embraced in the long-life ahead mines decrease in value outward and downward.

(b) Most such deposits are explored first in their upper central portions, that is, where the ore is best and where surface indications were probably most attractive, and only with time are the explorations pushed to the lateral and bottom limits of the deposit.

(c) It is natural that actual operation, that is, ore extraction, shall begin approximately at the point where exploration began. Indeed, commonly, extraction has already been going on there before the marginal portions of the deposit are completely developed. It takes time to gradually extend operations laterally outward to the margins, where the lower-grade ore generally lies.

(d) In several instances already passed into history, the figure regarded as the basic economic limit of ore-grade a few years ago has now been so lowered that what was 'waste' then, is 'ore' now.

(e) Regardless of improvements in methods and processes, there will always be a tendency to make sure now of at least the better grades of ore, and to go somewhat more slowly with the lowest grades, in order that improvements in technique may come to light that will simplify the problem, or that the difficult job may be passed to someone else.

The foregoing considerations are amply confirmed by experience. The same conclusion is indicated by the general changes in ore-grade for the country as a whole. For example, definite statistics as to average yield of copper from all copper ores produced in the United States were first compiled in 1906 and are now available through 1916. These show that the tonnage of copper ore mined has increased from 18,000,000 in 1906 to almost 58,000,000 in 1916, and that in the 11-year interval the yield of copper from this ore has declined from 2.5% to 1.7%. If the great tonnage of low-grade native copper ore from Michigan be excluded, because it has stood nearly stationary in percentage yield (declining in the period only from 1.26% to 1.08%), the remaining copper ores have fallen from a yield of 3.56% in 1906 to 1.86% in 1916, a drop of almost half.

Changes of similar nature are indicated for the other principal metals.

The importance of these factors of declining grade of ore and increasing rate of production becomes very real in the case of mines of assured long life like the porphyry coppers, the first factor particularly in those deposits in which the geological process of secondary enrichment is involved. Let us suppose that a given mine has developed an immense tonnage as follows:

20,000,000	tons expected to yield	2.00
40,000,000	" " " "	1.75
60,000,000	" " " "	1.50
80,000,000	" " " "	1.25
100,000,000	" " " "	1.00
Total 300,000,000	tons of average yield	1.33

Let us suppose further that this deposit is now being mined at the rate of 5,000,000 tons per year, indicating a life at that rate of 60 years. Assuming an 8% return on the purchase price and redemption of capital by a sinking fund compounded annually at 4%, the indicated present purchase price of $80.00 worth of eventual total earnings is $15.84. Such would be the present value indicated by the tables of Inwood, Hoskold, and others.

But if we assume that the richer ore is mined first and the lowest grade ore mined last, the indicated present value becomes $19.77, or an increase of 25%. If in addition we assume that the present rate of output of 5,000,000 tons per year will be increased each year, say, by 4%, which indicates a doubling of mill capacity in about 18 years and a tripling of capacity in about 28 years (surely a conservative assumption for porphyry deposits), the life of the mine changes from 60 years to about 31½ years. The present value or indicated purchase-price then becomes about $22.40 by increased capacity alone, or about $24.75 by combination of increasing capacity and declining grade, or respectively 41% and 56% greater than the value indicated by the tables now in general use.

It seems to me that the factors of rate of production and grade of ore will have to be given serious consideration and that statistics will have to be compiled that will show how mines of various classes are likely to change their rates of production and how the ore that they mine is likely to change in grade. Then certain groups will have to be established to which a scale of factors indicated by these past-history statistics will have to be applied.

In arriving at a fair market-value as of March 1, 1913, one is supposed to take into consideration only the facts that were then known or that could have been then known had one endeavored to learn them at that time. The question may therefore arise as to whether it is fair to arrive at a 1913 valuation by applying to the standard present-value method of mine valuation modifications which have not been proposed until 1919. In my own opinion, however, there is sufficient justification for using those modifications that are consequences of taking into account changing grade of ore and changing rate of production.

In arriving at valuations by the present value method, certain of the data must originate with the mining company, namely, tonnage and grade of ore, percentage of extraction, and cost and rate of production, for these various factors either are direct consequences of the nature of the mineralized ground which the company owns or are results of the policy and methods which the company chooses to apply. Of course, they will all be subject to check by the engineers of the valuation section of the Revenue Bureau. There is one necessary factor, however, which must come from other sources than the company concerned, namely, the probable selling-price of its product over the period of indicated life of the property. That the selling-price is a factor of utmost consequence in the computation of present value has been emphasized by previous writers. It therefore seems to me that careful and detailed research must be put upon this subject when so vital a job as valuing all the profit-making mines of the country is to be faced.

A matter upon which all possible illumination is desired from mining engineers and geologists is the proper handling of 'probable' and 'prospective' ore in the computations of tonnage. My own feeling in this connection is that the decisions reached must be in accord with a thorough understanding of ore deposition and occurrence rather than rest on any arbitrary or conventional limitations and rules.

The clause in the latest tax law which permits revaluation of property if discoveries made by the taxpayer have caused a real change in value, is clearly going to be difficult of application. Without endeavoring at this time to indicate either the present attitude of the Bureau on this subject or my own opinions regarding it, I wish to emphasize that suggestions from the mining industry as to the application of this discovery clause will be welcome in Washington and will undoubtedly aid in the solution of this important question. Particular attention may well be directed to these questions: What is meant by discovery of a mine, what constitutes discovery according to that meaning, and when is such discovery achieved or completed?

Question has been raised as to how or at what rate depletion is to be allowed, for instance, whether coincident with the exhaustion of the deposit, or at a faster or slower rate. This is another of those matters upon which professional advice will be welcome. In the meantime, I may confess that the plan of allowing depletion in direct proportion to the actual exhaustion of ore seems to me most equitable and simplest of application. In this connection, it may be pointed out that if the coincident rate of depletion is adopted, the actual depletion allowances should be computed on weight of metal actually produced rather than on number of tons of ore, assumed to possess average grade, mined during the year.

The remarks thus far made with respect to valuation are related primarily to the relation between mine values and depletion deductions. The matter of proper depreciation allowances on physical property must also be decided and in this connection an effort will be made to determine the intent of the law with respect to those three main factors ordinarily comprehended in the inclusive term depreciation, namely, physical wear or decay, obsolescence, and inadequacy. Also effort will be made to settle on a sound principle of depreciation, that is, to decide as between one of the several methods now current, such as the straight-line method, the reducing balance method, or some other. Due consideration ought to be given to the fact that the usable life of equipment may outlast the life of the property on which it is to be used and a correspondingly rapid rate of depreciation therefore allowed from the start.

The excess profit tax raises problems which all of us might well wish to escape, but which nevertheless must be faced and solved. No effort will be made in this paper to go into its details, but I may express the conviction that the assistance which the valuation engineers will afford in arriving at the fair quantities to be taken for invested capital and paid-in surplus for the mining industry will necessarily arise from the sound and accepted economic theory that in this hazardous industry, "occasional great gains to lucky or shrewd investors must be accepted with equanimity; a policy" of control that is "too grasping over-reaches itself."† For, quite outside any ethical questions that may be involved, this practical situation has to be faced, that taxes which take up to 80% of net income must be applied with due consideration of the necessity that profit-making industries must survive in order to supply the heavy taxes that will apparently be required for years to come. To whatever extent is proper, also, account should be taken of the fact that the pre-war average of earnings of the mining companies was on a higher percentage level than the earnings of ordinary enterprises because as already emphasized those earnings include cost of insurance in the one instance but not in the other.

Quite apart from the direct considerations of the subject of Federal taxation of the mines is a matter to which many of the mining companies have already, no doubt, given attention, namely, the effect of the Federal tax policy upon State, county, and local taxation. Deliberate valuations must of necessity be applied by the Government to most of the profit-making mines and other producers of natural resources in the country. To no other group of industries will such official and conspicuous valuations be applied. It may easily follow, therefore, that the true values set upon mining property, which are likely to be higher than most previous values for local taxation purposes have been, will result in the mines of those regions where the property tax prevails carrying a disproportionately heavy part of the local taxes, for the reason that all the other property except mines will not be brought up correspondingly to its true market-value level. In securing the benefit to be derived from full and fair valuation of their properties for the Federal income and excess-profit taxes, it is to be hoped that the mining companies will not suffer injustices arising nearer home, and it is to be desired that the local tax commissions may be brought to see this matter in the proper light.

†F. W. Taussig, 'Principles of Economics', Vol. 2, page 101.

REVIEW OF MINING

ARIZONA

COPPER PRODUCTION FOR SEPTEMBER.—DEVELOPMENT AT MORENCI.

DOUGLAS.—The Copper Queen smelter led in the output of copper for September for this part of the State with 8,600,000 lb., which is about half of the high point reached before the Armistice. An important event expected during October is the opening of the power-line between the smelter power-plant at Douglas and the power-plant of the Copper Queen branch of the Phelps Dodge Corporation at Bisbee. The Calumet & Arizona plant here produced 4,542,430 lb. of copper during September. The acid plant worked to capacity, producing between 5000 and 6000 tons of acid for the use of New Cornelia.

BISBEE.—Work on the site of the Copper Queen's 4000-ton mill is being pushed with a force of about 400 men. The steel contracts and machinery contracts have not been let as yet, but are expected to be awarded soon. The plant will handle the ore from Sacramento hill by a combination of flotation and gravity concentration. It is hoped to have it completed by July 1920, when it is anticipated that the Sacramento hill orebodies will be sufficiently developed to maintain steady shipment.

MORENCI.—Underground development has been started by the Morenci branch of the Phelps Dodge Corporation to prove its orebodies. Within the next six months it is expected that development will reach such a stage that the company will be able to figure with certainty upon its future activities, although the work now planned will require at least a year and a half to complete. At the end of six months it can be determined definitely, it is believed, what sort of mill will be necessary and what changes should be made in the smelter. The company is endeavoring to complete an arrangement whereby a number of its older employees, who are unfitted for hard physical labor, can be taken care of during the period of the shut-down of the mill, smelter, and mine production divisions. Leases in which the lessees can make a comfortable living with small exertion are being arranged for them. Many of the men formerly employed in the divisions now idle can be used in underground development, but many others will be compelled to seek work elsewhere.

HUMBOLDT.—The report of the Consolidated Arizona smelting company shows conditions are improving in this part of the State. From the Blue Bell and De Soto mines of the company 12,000 tons of ore was shipped to the Humboldt reduction works during September. The concentrator handled 7000 tons of raw material and the smelter proper treated 7000 tons of new metal-bearing ores and concentrates. During the month 600,000 lb. of copper in bullion was shipped to the eastern refineries. The majority of this copper was obtained from the company's properties in Yavapai county.

TOMBSTONE.—September exceeded any previous month in the history of the last two decades in this district for the amount of ore removed from mines under lease. Between 90 and 100 carloads of silver ore were sent from here to the smelters. There are now more than 100 lessees at work here, most of them attaining excellent results. Several new leases are expected to be in operation before the end of October.

JEROME.—Some extremely interesting ground is believed to lie about 160 ft. ahead of a drift being driven south from the west cross-cut on the 1200-ft. level at the Gadsden. If the cross-fault holds its course, it will be encountered at approximately that distance from the face of the south drift. The cross-fault does not show on the surface, and the east cross-cut encountered it unexpectedly. A broad belt of gouge as soft as putty was intersected approximately 160 ft. from the shaft. The material carried much water and is considered a likely formation in which to find ore; hence the anxiety to find the junction.

TUCSON.—The college of mines of the University of Arizona has a larger enrollment this year than ever before, not only in numbers but in the territory from which the pupils were drawn. The States represented by the men studying under Dean G. M. Butler are: California 7, Texas 6, Illinois 4, New York 3, Michigan 3, Oregon 3, Colorado 2, and one each from Washington, Ohio, Kentucky, New Mexico, Georgia, Alabama, Tennessee, South Dakota, Pennsylvania, Wyoming, Iowa, and North Carolina. One student from China also has registered. Many of the men have studied previously in similar institutions, both in the United States and abroad.

COLORADO

CRIPPLE CREEK AND LEADVILLE.

CRIPPLE CREEK.—Output from the mines of the Cripple Creek district for September was curtailed by the labor shortage and lack of experienced miners, who have left for districts where higher wages obtain. The closing down of the Vindicator Consolidated Gold Mining Co.'s mill also served to cut down the tonnage. The Vindicator company has declared its regular quarterly dividend of

one cent per share, a total of $15,000. The dividend will be paid on October 25 to stockholders of record as of October 15, when it is expected that G. S. Wood, the president for the company, will advise as to conditions on the Cripple Creek property and explain the shutting down of the milling plant. The total tonnage treated during September, together with smelting shipments, was 60,590 tons, with an average value of $11.96 and a gross bullion value of $590,255. Of this tonnage the Golden Cycle mill at Colorado Springs treated 24,000 tons of one-ounce ore and the Independence mill of the Portland Gold Mining Co., near Victor, 25,810 tons with an average grade of $2.09 per ton. Smelting-grade ore shipped direct totaled 760 tons of an average grade of $75 per ton. September dividends were limited to the distributions of the Cresson Consolidated Gold Mining Co., $122,000, and the Golden Cycle Mining & Reduction Co., $45,000. The last named company paid on October 10 the regular monthly dividend of three cents per share, a total of $45,000. The Cresson will suspend further dividend payments until mine conditions and funds permit.

The Lincoln Mines & Reduction Co. reports that the construction of its mill on Ironclad hill is nearing completion. A demonstration of the Gasche process, to be used at this plant, will take place inside of sixty days. F. G. Gasche, who has patented the process, is general manager for the company.

Citizens of Goldfield, including T. O. Roberts, city treasurer, and Abe Hawn, former mayor, have acquired title to vacant lots with the corporate boundaries situated on the eastern slope of Battle mountain, and are prospecting the ground by trenching. A shaft is also being sunk on what is believed to be the southern extension of the Harrison vein of the Golden Cycle system. The Portland company is cutting a station at the bottom level of No. 2 shaft on Battle mountain. This is 2283 ft. deep, 152 ft. below the Roosevelt Tunnel level connection with No. 2 shaft. The ore-shoot on the No. 2 Portland vein at the tunnel level has been proved for 1200 ft., and driving started south has shown ore still in the face. The Bonanza King on Gold hill, owned by the Midget Bonanza Gold Mining Co., has been leased to a local company operating under the corporate name of the Keystone Development Co. The property has produced rich ore from surface workings and will now be prospected from the 500-ft. level of the Midget shaft. The ore in Rose Nicol shipments is reported to be improving. A car of ore recently shipped by the Reva company, operating under lease, mined between the 800 and 900-ft. levels, brought settlement at $25 per ton.

LEADVILLE.—Under the ruling of Judge Henry J. Hersey of Denver, which upheld the contention of Lake county, property having an assessment valuation of one million dollars will be added to the Lake county tax rolls. Under this ruling, Lake county's northern boundary will be moved to include the rich molybdenum deposits of the Climax district. The bulk of the property within the disputed area is owned by the American Metal Company, and the treasurer of the company in the past has paid taxes to the treasurer of Summit county at Breckenridge. While Lake county is talking of bringing suit to recover back taxes, Summit county attorneys are preparing an appeal to a higher court. In addition to the mines, the American Metal Company owns a large mill at Climax, and the town is also within the strip, which is five miles long and one and one-half miles wide, containing six to seven square miles of land.

MICHIGAN

REVIEW OF THE METAL OUTLOOK.—PRODUCTION FROM THE MINES.

It is stated that no effort to increase production in the copper mines will be made this winter. The present indications are that the output of copper for the year 1919 will be the lowest it has been since the strike. If the total is to reach 150,000,000 lb. there will have to be a large increase in output for the fourth quarter of the present year. No such increase is expected, although it may easily come if there should be any sign of a normal demand for the metal.

Michigan production of copper was 231,096,158 lb. in 1918; 268,508,091 lb. in 1917; 269,794,531 lb. in 1916; 238,956,410 lb. in 1915; 158,009,748 lb. in 1914; and 155,715,286 lb. in 1913. The low outputs in 1913 and 1914 are accounted for by the fact that there was a very small foreign demand for copper. Germany, before the War, was the greatest foreign market for Michigan copper. When this market was shut off by the blockade, it took the Allies some time to realize how large their demands would be for copper for munitions.

There is as yet no resumption of the demand from Germany for copper for manufacturing purposes, and there is a feeling that until such a demand does come there is not much hope for a change in the copper situation, particularly as it affects production from the Michigan district. Whatever sentiment there may be against the Germans, the fact remains that until Germany commences to buy copper there cannot be a demand sufficient to command a normal production from Michigan mines.

The New Arcadian and New Baltic, two prospects under the same management, decided to consolidate at a meeting of shareholders held in Houghton last week. This permits calling further assessments for development work. Seneca has purchased a mill-site from the Cliff company and plans for a stamp-mill, on Lake Superior, will be made immediately. Sinking has been resumed on the Seneca shaft, and driving is continuing. Lateral work on the first level made a total of 450 ft., of which 255 feet was north to the boundary line. The second level was started October 1. Osceola Consolidated produced 54,000 tons of copper ore in September, compared with 56,700 tons in August. Most of this came from the Kearsarge branch. Ahmeek produced 61,720 tons in September, an increase of 5000 over August. Allouez increased 2000 tons in September to 15,210. Mass Con. now is shipping 500 tons daily and in September sent 14,000 tons to the mill, not including mass and barrel stuff that went direct to smelter. Baltic, Champion, and

Trimountain mines of the Copper Range group are maintaining their high standard, Champion rock running 40 lb., the richest in the Michigan district.

NEVADA

LABOR CONDITIONS IMPROVING AT TONOPAH AND DIVIDE.

TONOPAH.—Labor conditions at Tonopah and Divide are improving rapidly, and it is evident that the defeat of the I. W. W. element has been complete. Miners are returning to both districts in large numbers, particularly from Ely. The MacNamara mill a Tonopah, which treats Tonopah Divide and Divide Extension ore, has re-opened, and full crews are employed in the other mills, preparing them to be re-opened. It is reliably reported that, while the subject has not been discussed at the meetings of the operators, they are prepared to grant concessions to the workers as soon as the newly organized miners' local union gains a full membership. The men returned to work without receiving any concessions and it is known that the operators will willingly grant either a 50-cent raise or a co-operative store, whichever the men desire. Many miners are unemployed in the districts and will remain so because of their activities at meetings of the radicals during the strike.

SIMON DISTRICT.—P. A. Simon, president of the Simon Silver Lead, has bought control of the Norman, 1½ miles south of the Simon and adjoining the Fagan. Sinking the shaft from 200 to 300 ft., or to the sulphide zone, will be started immediately with two shifts. The shaft of the Simon Mina, 1 mile north of the Simon Silver Lead, is 160 ft. deep. A cross-cut to the vein will be started at 200 feet.

GOLDFIELD.—In a 150-ft. drift on the 500-ft. level of the Red Hill ore 18 in. wide has been exposed continuously for a distance of 70 ft. The highest assay obtained is $40 and the average grade is much lower. This ore is far south of the fault striking east through the Florence, beyond which a body of shipping ore has never been found. After the lateral extent of the shoot has been determined raising will be started. The effect of this fault on the main Florence vein and on the Jumbo vein of the Development company is to be determined through drifts from the south-east cross-cut recently started on the 350-ft. level of the Florence. A drift driven south in a 1-ft. seam of ore on the shale-latite contact in the Grandma has been discontinued owing to the ormation becoming badly broken, and a drift has been started north in the same shoot. Assays of from $30 to $38 are being obtained. A cross-cut is being driven south from near the face of the east drift on the 375-ft. level of the Great Bend in an attempt to open the extension of ore found on the 236-ft. level. The drift has been driven beyond where this ore should have been found and the cross-cut will be used in prospecting in the vein, which is from 60 to 70 ft. wide. A cross-cut driven 18 ft. north at the face of the drift encountered a heavy flow of water, leading to the belief that it is draining the Lockhart shaft, less than 500 ft. to the east.

GOLD MOUNTAIN.—The Washington Gold Quartz Min-

Photo by Tune, Goldfield

THE GLORY-HOLE AT THE COMBINATION SHAFT, GOLDFIELD, NEVADA

ing Co. plans to employ two shifts of miners as soon as houses for more men are erected. A contact of lime and porphyry is being explored on the surface and good assays for gold, silver, and lead are being secured. Numerous trenches and shafts of a maximum depth of 20 ft. have exposed the contact for a distance of 3000 ft. A tunnel is to be driven in the contact vein, which strikes east with several promising cross veins entering it from the north and south. The contact vein is rather flat and the cross veins stand nearly vertical.

WISCONSIN

DESCRIPTION OF THE ZINC FIELD.—OPERATIONS FOR SEPTEMBER.

The Upper Mississippi lead and zinc district is found in the extreme south-west corner of the State of Wisconsin, in three counties of Grant, Iowa, and LaFayette, and adjoining portions of Jo Daviess county, in Illinois. The district is about sixty miles in length, north and south, and about forty miles east and west. The leading mining camps have been, for more than forty years, Highland, Montfort, Linden, Dodgeville, Mineral Point, Livingston, Mifflin, Rewey, Platteville, Big Patch, Elmo, Cuba City, Meekers Grove, Benton, Shullsburg, Hazel Green, and Galena. Sporadic deposits have been found at points variously distant from the established mineral areas and considerable stretches of country between the camps are believed to be barren, so that the grouping of active ore producers at the present time is patchy and irregular. The Wisconsin district is one of the oldest in America. As early as 1780 French traders, under Julian Dubuque, bought considerable lead ore from the Indians. In 1823, lead mining under pioneer white settlers began at Shullsburg and Galena; and by 1846 over 2000 lead leases had been granted to miners by the general government. The first zinc ores were mined in 1862 at Centerville near and around Highland. These were the carbonate, known, in miners' terms, as 'dry-bone'. These mines still exist and are at this time being mined extensively by the New Jersey Zinc Co., which owns thousands of acres of fine farm land on the trend of the ranges established many years ago. The ore has been used largely in the manufacture of oxide of zinc, large quantities of which are utilized in the manufacture of paint.

Blende or sphalerite was of little value until about 1903, when modern methods were more generally introduced into the field. Before that time it was generally discarded. The sharp rise in the production of 1916 and 1917, due to the War, brought out the fact that the field had greater resources than it had been supposed. The output of the mines exceeded 250,000 tons of zinc ore, a large quantity of lead ore, and thousands of tons of pyrite, the last named being used in the manufacture of sulphuric acid. The field is also a fine farming district. Railroad facilities are good. The Chicago & Northwestern railway enters the field at Dodgeville, the county seat of Iowa county and ends at Lancaster, the county seat of Grant county. At Montfort a junction is formed with the Galena division and the route covers the very heart of the entire mining field. Many producers of zinc ore and lead ore are situated practically upon the right-of-way. The Chicago, Milwaukee & St. Paul ends at Mineral Point and a branch extends west to Platteville. The Illinois Central and the Chicago, Burlington & Quincy are other roads serving the district. Mining is done on a leasing system, 10% royalty being allowed on the gross return from ore sales, except where the larger operating groups purchase a mine outright, which is not infrequent. The leasing system has resulted in close associations between land owners, the farmers, and the mining operators. This is a splendid asset for the miners as it aids materially in prospecting and development work and has restricted the activities of labor agitators, from which the district has been exceptionally free.

The four largest operating corporations are the Mineral Point Zinc Co. the western branch of the New Jersey Zinc Co.; the Wisconsin Zinc Co., a subsidiary of the American Zinc & Lead Smelting Co.; Vinegar Hills Zinc Co.; and the Frontier Mining Co. The success of the field in the main is founded on the working of large bodies of low-grade ore at low cost. The average zinc content of the milled concentrate for the entire field is about 25%. During the past year conditions in the industrial world responsible for irregular and at times uncertain markets have compelled operators to mine richer ground and at the same time improve the grade of concentrate, bringing the grade of concentrate to about 30%. The ores consist of blende, smithsonite, and galena, all more or less associated with marcasite and pyrite. These ores are found in openings, pitches, and flats, and disseminated deposits, classified as top and bottom runs. The early miners who sought lead ore exclusively sank shallow test-pits, seeking the crevices by narrow connecting drifts. The field in spots is pitted with these old shafts and the hummocks or burrow piles marking their location. These shafts never went below water-level because the pioneer miner was not especially well equipped with pumps, and indeed many clung to the theory that the water-level cut out any further extension of the ore. Zinc in that period was valueless because no market was offered for it, which explains why at this time prospectors seek the old lead ranges for deposits of zinc ore. Churn-drills were introduced into the field about 1900. These were light in construction and poorly equipped for deep borings or hard ground. Now well equipped and efficient drillers are numerous.

Location of shafts is largely determined by the prospect drilling. The depth ranges from 60 ft. to 200 ft., at bottom of which a sump of from 10 to 15 ft. is left below the working level. From the collar down to the solid rock the shaft is cribbed with timber or concreted. Producing-shafts contain two compartments, one for ladder and pump columns, the other for hoisting. Average size 'cans' are used, capable of holding 1200 lb. of ore. Cages are employed at some of the larger mines and record recovery shows as high as 500 'cans' of dirt raised in a single 9-hour shift. Ground is broken by underhand stoping. Air-hammer drills are used in the headings. The broken ore is shoveled into cars, at prices ranging

from 9 to 11c. per "can" of dirt, according to the number of "cans" filled. At one of the leading producers 9c. is paid up to 40 "cans", over 40 and up to 50, 10c.; over 50, 11c., and in addition a bonus of 1c. per "can" is paid to employees on six successive shifts. Mules are largely employed for underground tramming. At one or two places underground electric locomotives are used. On short hauls hand tramming still finds favor with the management.

Most of the mills in operation are about identical in appearance and design. They range in capacity from 50 to 250 tons per nine-hour shift. The same mill may show different records according to the quality of the ore. Three recoveries are made: galena, blende, and tailing. Some deposits are free of galena, but others carry a good deal, as well as small amounts of marcasite. The marcasite tends to go with the wet concentrate on account of the similarity in specific gravities. Many attempts have been made to eliminate this before the ore reaches the mill, but little attention is given now to this because of the development of electro-static separation. Sliming is avoided as much as possible. Effort has been made to save waste through the use of sludge or slime tables, but these are no longer used. Electric power is supplied to mines and mills by the Inter-State Light & Power Co. of Galena, which now covers the entire field.

A VIEW OF THE MELOY MINE OF THE VINEGAR HILL ZINC CO., SHULLSBURG, WISCONSIN

The Wisconsin zinc field invites further exploration, especially in the territory intervening between the ranges. Intelligent prospecting and exploration work with drill now enables the operator to block out the ore in advance of operations. The field is near the coal mines and smelters of Illinois, which offer a satisfactory market.

During September many obstacles prevented increased production by the zinc and lead mine operators, and materially reduced the profits. Strikes in different parts of the country were mainly responsible for the difficulties. A scarcity of cars, which was acute at one time, delayed production appreciably, and labor conditions were difficult, machine-men especially being in sharp demand.

Prices paid for zinc ore at the beginning of the month were as good as could be expected. Premium grade blende, the output of electro-static separating plants, held firm on a base of $46 per ton, for both first and second-grade stock. At nearly all the electro-static plants, concentrate assaying more than 60% was obtained, and one mill produced concentrate averaging 63%. In such grade the premium no doubt brought the price to a high figure of $50 per ton for the month. This price of $46 per ton, base, held for the first fifteen days of the month, at the end of which a break came, the price receding to $43.50 per ton, base, for first grade and $42.50 for second-grade ore. This price held for the remainder of the month. Producers and sellers of low-grade were receiving 60c. per unit, which left a margin of profit sufficient to keep the small independent mines operating.

Lead-ore producers were in a better position, as a marked advance in prices was made during the month. Opening at $67.50, with demand good, the price jumped in the middle of the month to $70 per ton, base, 80% metal content. This figure, however, did not hold long. The last half of the month saw the base creep upward steadily until $72.50 was reached locally, and some sales of exceptionally clean product were marketed at a point in advance of $75. This figure held at the close and still no disposition was shown to unload surplus stocks, held in reserve for many months. The same optimism that has prevailed for months pervades mining interests; some of the operators are foretelling $85 per ton before the end of the next thirty days. Several new mines are doing much to increase the production of galena, and the unsold reserve in the field at the close of the month was variously estimated at from 1200 to 1500 tons. As the bulk of this is obtained as by-product in the process of wet concentration, it appears that operators will pursue their waiting game a while longer. Carbonate of zinc held steadily all month at $26 to $30 per ton, 40% base. Sales were light and independents did not share in the marketing.

Deliveries of ore, from mines to reduction plants in the

field, and from mines to smelter direct, were made for September as follows:

District	Zinc, lb.	Lead, lb.	Pyrite, lb.
Benton	12,982,000	80,000	1,676,000
Galena	4,056,000	546,000	.....
Livingston	3,600,000	160,000	.....
Cuba City	1,654,000	344,000	1,984,000
Shullsburg	992,000	88,000	.....
Highland	960,000	.....	.....
Hazel Green	412,000	.....	.....
Total	24,656,000	1,218,000	3,660,000

Refiners did not make the return ordinarily reported from month to month, one of the leading establishments being out for a time re-lining hearths. Shipments were made as follows:

	Lb.
Mineral Point Zinc Co	5,242,000
Wisconsin Zinc Co	3,628,000
National Zinc Ore Separating Co	3,000,000
Linden Concentrating Co	870,000
Total	12,740,000

Of the raw ore output disposed of to reduction plants, the Mineral Point Zinc Co. received 5209 tons; Wisconsin Zinc Co. 3551 tons; National Zinc Ore Separating Co. 2340 tons; Linden Zinc Co. 1228 tons. Of the high-grade separator product, the Mineral Point Zinc Co. received 2521 tons, and 479 tons of carbonate zinc was shipped to smelters direct. The American Zinc Co. received 1486 tons of premium blende; Grasselli Chemical Co. 1005 tons; United Zinc Smelters, 780 tons; American Metal Co. 506 tons; Illinois Zinc Co. 187 tons. The gross recovery of wet concentrate for September was 12,282 tons; net deliveries 7064 tons.

BRITISH COLUMBIA

LABOR TROUBLES.—CONCENTRATORS FOR ROSSLAND AND KIMBERLEY.—PREPARATIONS FOR WINTER IN THE SALMON RIVER DISTRICT.

Labor troubles have closed down operations on three of the most important of British Columbia's metal mines. Two of these are situated in East Kootenay, namely, the Sullivan mine, owned by the Consolidated Mining & Smelting Co. of Canada, and the North Star mine, Kimberley, which has been shipping regularly to the Trail smelter. The third is the Nickle Plate mine, owned and operated by the Hedley Gold Mining Co. The Hedley mine was the greatest producer of gold in British Columbia for years, until the Surf Inlet mine began operating on a considerable scale two years ago. The production has averaged around $700,000 a year. The ore is arsenopyrite and the Tacoma smelter, which has been treating the concentrates, has been paying for the arsenic content during the past two years. Ore valued at between $4,000,000 and $5,000,000 is in reserve. With the fall in the purchasing power of gold and the increased cost of production of late the company's profits have been seriously affected. On top of this came a demand for an increase of wages from the miners and fifty cents a day was granted. A like amount again has been demanded and the directors have decided that, as this would mean operating at a loss, they would be better off to close the mine and mill. As a result a force of about 100 miners will be thrown out of employment, a small force only being retained on development.

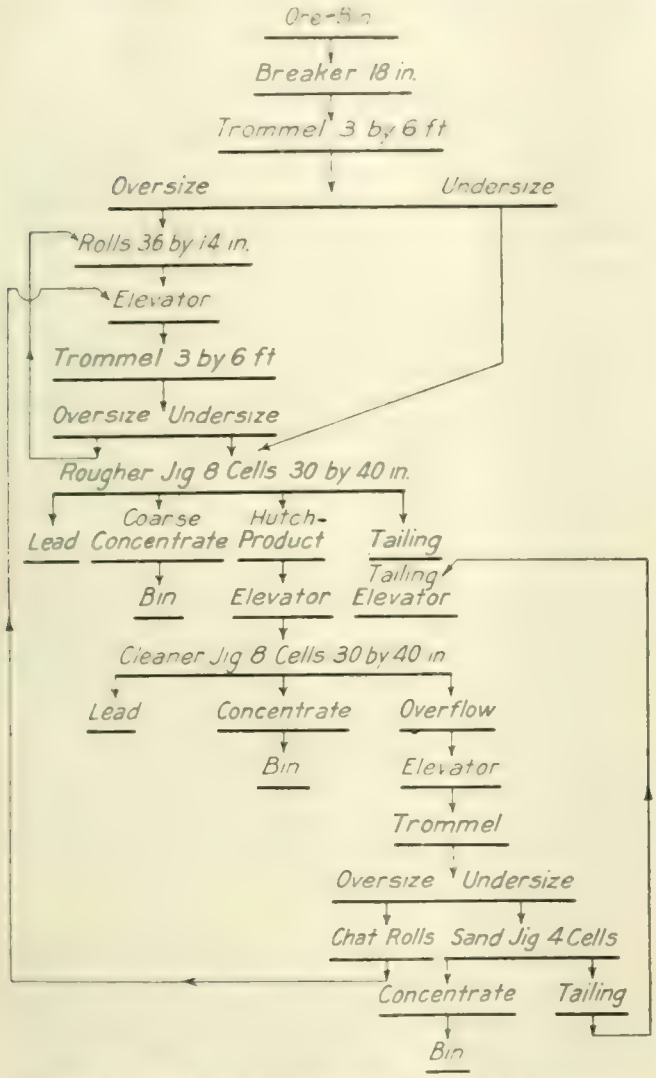
The Sullivan mine is the chief source of zinc ore for the Trail smelter, the production of which is between 18,000 and 20,000 tons of zinc per annum. It is observed that the strike of the miners and the consequent practical closing down of the mine is likely to interfere with the company's taking advantage of its agreement with the Dominion government, which is a part of the war supply contract and under the terms of which the smelter received a minimum price of 8c. per lb. for its zinc.

At a recent mass meeting of the miners of Kimberley matters relating to the strike were discussed. Negotiations looking to an adjustment have been conducted through a representative of the Department of Labor, Ottawa, a proposal being made to the men that, if the One Big Union was repudiated, the companies would be prepared to meet a committee of the employees. The appointment of a Board of Conciliation under the Industrial Disputes Act was the method suggested as being most likely to effect a settlement. However, while the Miners' Committee claimed it did not represent the 'One Big Union', the miners in attendance declined to give an understanding that they would repudiate it. Consequently negotiations ceased. The Government representative has returned to Calgary and the companies are said to be preparing for a long strike.

TRAIL.—The Consolidated Mining & Smelting Co. is considering plans for the erection of two concentrating plants, one at Rossland and the other at Kimberley. The Kimberley plant is said to be planned for a capacity of 10,000 tons daily at the outset, with the possibility of the erection of another unit of the same size, which would make the total capacity 20,000 tons. If the project thus outlined is carried through the concentrator would be the largest on the continent. Plans for the Rossland plant have been under consideration for some months. It was proposed at first to provide a 1500-ton plant, but recent reports are that the company now has in mind one with a capacity of 5000 tons. The chief problem at Rossland has been a source of water. The city has the first right to the supply, but has shown a disposition to share it liberally with the smelting company. The construction of a dam in the mountains near Rossland, it is believed, would take care of this need, although there is no doubt that the expense of the undertaking would be considerable. The proposed site of the Rossland concentrator is between the War Eagle and the Le Roi mines, and the sources of ore would be the Le Roi, War Eagle, and Centre Star mines, which are the property of the Consolidated Mining & Smelting Co. In these are large reserves of low-grade copper-gold ore. At Kimberley the chief ore supply will come from the Sullivan mines of the Consolidated company. From these properties from 2000 to 4000 tons of lead and zinc ores are shipped weekly. In addition to this ore, which is of smelting grade, the mine contains a large quantity of ore carrying

zinc and lead in smaller quantities. Its removal at a profit was a problem until a year ago, when it was announced that it had been solved by the metallurgical staff of the company at the Trail smelter.

Salmon River.—In the Salmon River district, Portland Canal, preparations already are being made for winter by the various mining companies. The snow comes early and stays late in the hills of this region.



FLOW-SHEET OF A TYPICAL MILL IN THE WISCONSIN ZINC DISTRICT

While it is impossible as yet to say just how many men will be employed at the various mines throughout the winter, it is certain that there will be a substantial payroll and that the centres of Stewart and Hyder will continue to be quite bustling and active throughout the closed season. Among the companies that will continue to operate are the Premier, Bush, Big Missouri, Forty Nine, Mineral Hill, and the New Alaska, the last being on the Alaskan side of the boundary line. These all are in the Salmon River district. On Bear creek it is expected that the Lakeview, recently bonded by P. Welch and associates, and possibly the George copper properties will maintain operations. Although all these properties are reported to be in such shape that work can be continued through a hard winter, the mainstay will be the Premier, on which a considerable force will be employed. During the summer the efforts of the Premier company have been devoted to a large extent to road building. On the Big Missouri, diamond-drill operations thus far are said to have been highly satisfactory. A similar report comes from the Forty Nine property on which drilling is in progress. It is said, in regard to the latter, that the short tunnel which was driven to intersect the vein encountered high-grade ore, on which drifts are now being driven. Those interested in Salmon River properties are, in general, satisfied with the season's work. The development on many properties has been almost all that was hoped for, and mine operators and prospectors are looking forward to next summer.

ONTARIO

OPERATIONS INCREASING IN THE NICKEL DISTRICT.—WASAPIKA OBTAINING FAVORABLE RESULTS.

Sudbury.—The nickel industry is recovering from the depression resulting from the close of the War and is looking for new markets. The International Nickel Co. is devising plans to encourage the use of nickel in new ways, and more especially to extend its employment as an alloy in connection with the manufacture of automobiles and other vehicles for which a hard metal is required. The company is steadily increasing the scope of operations after the curtailment of its output following the Armistice. It has now about 1300 men at work. Mining has been resumed at Creighton mine and the output of Bessemer matte has been increased to about 3000 tons per month. Crean Hill mine, which was producing during the War, remains closed. The bridge for handling the ore at O'Donnell roast-yard has been completed. At Coniston, seven miles east of Sudbury, where the plant of the Mond Nickel Co. is situated, work is also increasing. After the Armistice the company curtailed its operations by about one-half. It is now employing 700 men, and after considerable delay, shipments of nickel matte to the refinery at Swansea, Wales, have been resumed. The company has for some time had in contemplation an extension to double the capacity of its plant, involving a total expenditure of $3,000,000. The present smelting plant is four furnaces and three converters, to which it is proposed to add three new furnaces and three converters, bringing it up nearly to the size of the International company's plant. Work on this was held up by the unfavorable conditions. The British-American Nickel Corporation is still engaged in construction work, but expects to begin operations early in the winter. It is building a plant at Nickelton, three miles north-west of Sudbury, which will have three furnaces and three converters and will employ 1800 men at the outset. A force of 800 is now engaged in the work of construction. The supply of ore will be drawn from the Murray mine in the immediate vicinity of the smelter, where 8,000,000 tons of ore has been proved. The refining will be done at Deschenes, Quebec, on the Ottawa river, where a plant is under construction. The electrolytic process will be used.

Kirkland Lake.—The strike of miners is still unsettled, but the men that remain in the camp appear anxious to resume work. Several of the leading mines have re-opened or are making preparations to do so. The Lake Shore was the first to resume operations. The Teck-Hughes is re-organizing its working force and has secured a number of men. The Kirkland Lake and Wright-Hargreaves will be operating very shortly. The general shortage of labor may for a time considerably restrict operations, but relief is expected shortly, as it is officially stated from Ottawa that unemployment is increasing and an influx of labor into the mining districts is anticipated.

Cobalt.—The mines are generally in full operation with plenty of labor obtainable. One result of the strike is that unrest and agitation have disappeared, with a marked improvement in the efficiency of the working forces. The ore-reserves of nearly all the producing mines have recently shown a considerable increase, which with the increased value of silver places the industry on a favorable and satisfactory basis.

West Shining Tree.—At the Wasapika a cross-cut at the 100-ft. level has gone through 50 ft. of vein matter without reaching the limit of width. The ore is reported to be excellent, showing visible gold.

QUEBEC

Lake Du Parquet.—A new mining field may be developed at Lake Du Parquet, close to the Ontario boundary at a point near Lake Abitibi. Geological conditions are stated to resemble in some respects those of the Porcupine field. Quartz veins occur which are reported to show some mineralization, and a small amount of visible gold has been found, although assays have not so far indicated ore. A number of claims were taken up a year or so ago, but the interest in the field soon subsided. It is now announced that the Timmins interests of the Hollinger have secured an option on the Bishop claims, one of the most promising prospects, and have also had a representative staking other claims which will be subjected to a thorough exploration. This is directing the attention of many mining men to the area.

SONORA

CHANGES IN THE POWER-PLANT OF THE MOCTEZUMA COPPER CO.—PRODUCTION FIGURES.

Nacozari.—The Moctezuma Copper Company is changing its steam-turbine power-plant to Diesel engines, and is increasing the horse-power of its plant. Eight Diesel engines are being erected, four of 1000 hp., two of 1500 hp., and two Diesel-driven air-compressors of 750 hp. each. The latter equipment will result in increasing the company's drill capacity for underground development. The Moctezuma company's mill soon will be overhauled and almost completely re-modeled. A series of experiments conducted at the Copper Queen smelter in Douglas has resulted in development of variations in the flotation process suited to the Moctezuma ores, and will serve to guide the design of the mill. The present mill capacity of 2400 tons will be increased to 3000 tons.

El Tigre.—The property of the Lucky Tiger Combination Mining Company is maintaining its average ore production. During September the mine production was 6367 tons, all of which went to the concentrator. Twelve carloads of concentrates were shipped to El Paso for smelting. During the latter part of the month the company made connection between the main working shaft and the main haulage level. Installation of an electric haulage-system in the mine also was completed during the month. The main shaft now has been sunk below the eighth level or about 1300 ft. below the point where the main vein is exposed upon the surface.

Agua Prieta.—Imports made into the United States through this port during the month of September amounted to 229 carloads of ore, 10,041 tons, valued at $1,856,900 gold. This marked a small increase over the previous month, but in August heavy rains, which washed out the line of the Nacozari railroad, delayed ore shipments to a considerable extent. Of this total properties surrounding Nacozari shipped 209 cars, or 9360 tons. El Tigre shipped 12 cars of 450 tons. The following shipped one car each, of the tonnage designated: Rosales 41, San Pablo 39, La Nueva Amistad 16, Las Chispas 29, Madame Esther 3, San Jose 35, San Nicolas 39, San Ygnacio 29.

Cananea.—This district came nearer to attaining normal production in September than any in the Arizona-Sonora belt. The total output of the smelter of the Cananea Consolidated Copper Company for September was 4,500,000 lb., which was within one million pounds of the record figure in the company's production. It indicates plainly the return of the company to normal. There was some trouble in the latter part of the month at the company's Puertocitos mine, as a result of a dispute between the American foreman and native laborers which brought on a strike. This was adjusted satisfactorily, however.

Pilares de Terras.—John Hohstadt, pioneer miner and cattleman of northern Sonora, is making preparations for opening a prospect he owns, adjoining the Roy and Cinco de Mayo properties. He will run a development tunnel approximately 1500 ft. in order to strike the orebody exposed on the surface. The work will be contracted.

CHIHUAHUA

Mining in Chihuahua and central Mexico is showing an improvement as a result of lessened activities on the part of revolutionists and bandits. The American Smelting & Refining Co. is constructing a machine-shop at its smelter at Avales, near the city of Chihuahua, and will be receiving ore from the Santa Eulalia and Parral districts in a short time. Several mines owned by American companies in this district have been placed in operation again, and a number of American mining men who left their properties when Villa was active in the vicinity have returned to their duties. Among the more important mines upon which operations have just been resumed is the Tecolotes at Santa Barbara.

ALASKA

Fairbanks.—Constitutionality of the Alaskan Legislative Act of 1915, requiring the filing of affidavits showing that the annual assessment work has been done on mining claims, was sustained on October 13 by the Supreme Court, which declined to interfere with the conviction of G. A. Vedin, at Fairbanks, under this statute. Vedin was sentenced to three years' imprisonment.

ARIZONA

Globe.—The Old Dominion Copper Co.'s production is now two-thirds of normal, the production for August having been 1,937,000 lb. The Kingdon shaft is now being sunk from the 1950-ft. level to the 2150-ft. level.——Work on the concentrator of the Iron Cap Copper Co. has been started. The first unit of the plant is to be approximately 500 tons capacity. Other units are to be added as required. David Cole is consulting engineer for this work.

Johnson.—The Keystone Copper Co. is working six men driving on the 600-ft. level to cut ore opened on the 400-ft. level.——The Republic mine has resumed operations. Seventy men are now at work and production is in the neighborhood of 2000 tons per month. This output is to be doubled in the near future. Plans are being made to sink an 800-ft. shaft to replace the present inclined shaft.

Kingman.—The Tipperary Mining Co. has purchased the McKesson group of mines about six miles north of Wallapai station. The company's machinery at Oatman is to be shipped to the new property. Shallow cuts and drifts together with a 40-ft. shaft is all the development work that has been done on the property.——The Pawva Company, six miles east of Kingman in the north end of the Wallapais, has opened good ore in the drift on the 180-ft. level. The company has purchased the Last Chance mill, which is now being overhauled. G. W. Gibson is manager.

Miami.—The Miami Copper Co. has declared a dividend of 50c. per share for the quarter ending September 30, payable November 15 to shockholders of record at the close of business on November 1.

Oatman.—The United Eastern Mining Co. has declared a dividend of 7c. per share, payable on October 28 to stockholders of record at the close of business on October 8.

Patagonia.—It is reported that the Sunnyside mines, which are situated near the World's Fair, the Three R, and the Trench mines, have been bonded to the Cananea Copper Co. for $200,000.

Prescott.—Development at the King mine near Hillside is progressing favorably. The shaft has reached the 400-ft. level, at which point driving is to be started. Ten tons of ore per day is now being produced.——A carload of carbonate ore from the Dundee Arizona Copper Co. is to be tested in the new leaching unit at the Humboldt smelter.

CALIFORNIA

Adin.—Hess Gold Mining Co. has decided to sink a new working shaft 500 ft. The old shaft is 350 ft. deep and was sunk at the point of discovery. The Hess for several years has been a consistent gold producer.

Forest.—Driving to the west is proceeding from the main level of the North Fork to seek a vein in the foot-wall. Near surface this vein is said to have shown excellent ore. George F. Stone is superintendent.

Genesee.—A carload of copper-silver-gold ore, sampling $150 per ton, has been shipped from the Piolet mine to the International smelter. Development of the vein is exposing considerable shipping ore, and the owners plan to send out another carload shortly. The Piolet adjoins the Genesee and Five Bears group and is owned by Albert and Joseph Goodhue.

Grass Valley.—The Central Consolidated Mining Co. has been organized in San Francisco to take over the Central, Banner, and North Banner mines. Plans for a mill of 5000 tons per month are being drawn.

Hayden Hill.—Development of the old Juniper is in progress, and it is understood a small mill will be purchased. The ore is gold-bearing and of good grade. The mine is being rehabilitated by Frank Harbet and Peter Keogh.

Meadow Valley.—Greenbower Mining Co. is building a new wagon road and has arranged for the construction of a restraining dam, ditch, and pipe-line. The dam is to be 280 ft. long, 35 ft. high, and 85 ft. wide at base. It will be composed of reinforced concrete. Estimates place the gravel available for hydraulicking at 500,000 cu. yd. The mine is situated near Mount Ararat. H. J. Greenbower is manager.

Placerville.—James H. Zimmerman, who recently sold the Pacific Deep Gravel mine, seventeen miles east of Placerville, to J. E. Sexton, states that over a dozen men are busily employed erecting an air-compressor, air-drills, blacksmith and repair shop, and miners' change-room. This is preparatory to running a new cross-cut tunnel 1300 ft. long, 30 ft. vertically below the old 900-ft. cross-cut tunnel, in order to get in under the body of cemented gold gravel.

Redding.—Arbuckle Mining Co., operating the Bell Cow mine on Arbuckle mountain, has increased the working force and reports 50,000 tons of ore developed. Much of this is said to sample $10 to $15 per ton, with the richer shoots assaying $30 to $100 per ton. Frank Green, of Ono, is one of the leading owners.

COLORADO

Silverton.—The Sunnyside Mining and Milling Co. construction work is progressing rapidly; one bunk-house is completed and occupied, and painting and interior decorating is now under way. The compressor-house is completed, and the second bunk-house, commissary, and other buildings will be finished before the heavy snows come. Milling has been under way for several weeks, the old tailing-dump being worked over, with a recovery of zinc concentrate. The material is moved to the mill by an air-lift, then pumped in three stages to the tube-mills. Four thousand tons of ore is in the bins, and a mill-run is now being made on this ore. This will keep the mill running until October 15, when another shut-down is anticipated. Giachetti & Co. have assigned their lease on the Blacksmith level of the Champion to M. J. Arietta & Company.

IDAHO

Mullan.—Reports reaching Wallace are that the Gold Hunter mine will soon resume operations, when a night-shift is to report for work following the proposal of the miners to go back to work under the same conditions as those prevailing at the time of the strike last July.

Wallace.—The Consolidated Interstate-Callahan Mining Co. reports that the ore taken from the scene of the discovery made recently on the 500-ft. level is running 30% zinc, with corresponding amounts of lead and silver.

NEVADA

Carson City.—Mason Valley Mines & Smelter Co. has requested assistance of Nevada Public Service Commission in securing favorable freight-rates for custom ore shipments to the Thompson smelter. J. F. Shaughnessy, chairman of the Commission, has been delegated to take up the proposition with officials of the Western Pacific and Southern Pacific companies. It is stated the company plans to enlarge and improve the smelter at a cost ranging from $600,000 to $1,000,000. Special attention will be paid to custom ore from Nevada mines and properties located in Plumas, Lassen, and Modoc counties, California.

Goldfield.—The Florence-Goldfield Co. has arranged for the treatment of its ore at the enlarged mill of the Goldfield Development Co., and taken under lease territory from the C. O. D. and Red Hill-Florence companies adjacent to ground being explored from fifth level of the Florence. F. Somer Schmidt states it is the policy of the company to encourage lessees and that much ground now being explored may be given over to lessees following ore disclosures. The west cross-cut into ground leased from the Goldfield Development Co. has progressed 220 ft. and is showing veins of low-grade quartz. Reorganized Black Butte Co. has arranged to drive a south-east cross-cut from the 190-ft. level of the Dortch shaft to intersect a vein cropping prominently at surface.

Tonopah.—Tonopah Divide and Tonopah Hasbrouck companies have resumed ore shipments to the MacNamara mill. The Divide Extension will start shipments in a few days. It is reported that the Tonopah Divide shaft at a depth of 54 ft. is in ore sampling $57 across 6 ft. The shaft has been in ore from the surface, but not of such good grade.

Yerington.—The Bluestone Mining & Milling Co. is doubling the size of its flotation plant, which will make the capacity one thousand tons per day. The old unit has again been started up. It is uncertain when the new addition will be ready.——The Mason Valley Mines Co. has petitioned the railroad commission in Carson City for adjustment of the rates on ore to the Thompson smelter. The mining company states that it wishes to make a custom smelter out of its plant and to add reverberatory furnaces so that concentrates can be treated. It is believed that if the rates are lowered, the alteration of the plant will start at an early date and the mines of the district will soon resume operations immediately. The tonnage of oxidized ore in the district is rapidly becoming smaller and future operation of the smelter will depend on its ability to handle sulphide ores and concentrates.——The development of the Northern Light mine, 14 miles east of Yerington, has been encouraging. It is under option to the Mason Valley Mines Co. which has proved the existence of a body of sulphide ore at the shale contact.

WASHINGTON

The Kaaba Mines Co. has started the erection of a new plant at the mine to replace the temporary development plant now in use. The new plant includes a 600-ft. compressor, a 4000-ft. hoist, with a steel-sharpener, assay office, and complete electrical equipment.

Personal

The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

Edwin Ludlow has opened an office as consulting engineer at 149 Broadway, New York.

Clarence Woods, of Los Angeles, sailed on October 5 from New Orleans on his way to Honduras.

Morton Webber has been to Globe, Arizona, and to Butte, Montana, and is now at Mackay, Idaho.

Alfred H. Brooks, chief of the Alaskan branch of the U. S. Geological Survey, has returned to Washington.

W. W. Wishon passed through San Francisco on his return from the Cariboo district, B. C., to Los Angeles.

J. S. Williams, Jr., general manager for the Moctezuma Copper Co., has returned to Douglas from New York.

A. T. Thomson, assistant to the president of the Phelps Dodge Corporation, has returned to Douglas from New York.

H. Barzin, assistant superintendent of the Katanga Copper Co. in the Belgian Congo, is visiting metal mines in the West.

G. C. Martin, of the U. S. Geological Survey, passed through San Francisco on his return from the Upper Yukon to Washington.

R. W. Macfarlane, acting superintendent for the Arizona Copper Co. at Morenci, was in San Francisco last week on a short holiday.

H. Harrison Smith, son of W. Hinckle Smith, a director of the Utah Copper Co., was a recent visitor to the company's properties.

John McGregor, secretary-treasurer of the Flux Mining Co. at Patagonia, Arizona, is laid up with a broken leg, sustained while deer-stalking.

K. S. Twitchell, an American mining engineer in the employ of British interests on the island of Cyprus, was a recent visitor to Salt Lake City.

L. R. Budrow, general manager for the Lucky Tiger Gold & Silver Mining Co., at El Tigre, Sonora, returned recently from a stay of several weeks in California.

F. R. Reets, director of purchases for the A. S. & R. Co., was a visitor to that company's smelters in Utah, as well as to the Utah Copper properties, during October.

George L. Sheldon has made an examination of the Wyoming-Nevada Copper Co.'s property, near Imlay, Nevada, and is now on his way to Dillon, Montana.

D. D. Moffat and **E. W. Engelmann** of the technical staff of the Jackling management, were recent visitors to the mill of the Nevada Consolidated Copper Co. at McGill. They have returned to Salt Lake City.

L. S. Cates, general manager for the Ray Consolidated Copper Co., and assistant general manager for the Utah Copper Co., has returned to his headquarters at Salt Lake City after a business trip to British Columbia. **D. D. Moffat,** consulting engineer of mills for the Jackling porphyry properties, accompanied Mr. Cates.

R. C. Gemmell, assistant managing director of the Utah, Chino, Nevada Consolidated, and Ray Consolidated copper companies, left Salt Lake City on October 10 for Ray, Arizona, where he will meet **D. C. Jackling,** vice-president and managing director of the companies named. After inspecting the Ray properties they will go to the Chino properties in New Mexico. Mr. Jackling will then go to New York City for a several weeks' stay, while Mr. Gemmell will return to Salt Lake City.

R. N. Dickman, of the firm of Dickman & Mackenzie, at Chicago, died at La Jolla, California, on September 14.

THE METAL MARKET

METAL PRICES

San Francisco, October 14

Aluminum dust, cents per pound	60
Antimony, cents per pound	9.00
Copper, electrolytic, cents per pound	23.00—23.50
Lead, pig, cents per pound	6.50—7.50
Platinum, pure, per ounce	$130
Platinum, 10% iridium, per ounce	$150
Quicksilver, per flask of 75 lb.	$85
Spelter, cents per pound	9.25
Zinc-dust, cents per pound	11.00—13.50

EASTERN METAL MARKET

(By wire from New York)

Oct. 14.—Copper is more active and stronger. Lead is quiet and firm. Zinc is inactive but steady.

SILVER

Below are given official or ticker quotations, in cents per ounce of silver 999 fine. From April 23, 1918, the United States government paid $1 per ounce for all silver purchased by it, fixing a maximum of $1.01⅛ on August 15, 1918, and will continue to pay $1 until the quantity specified under the Act is purchased, probably extending over several years. On May 5, 1919, all restrictions on the metal were removed, resulting in fluctuations. During the restricted period, the British government fixed the maximum price five times, the last being on March 25, 1919, on account of the low rate of sterling exchange, but removed all restrictions on May 10. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the normal rate of exchange.

Date	New York, cents	London, pence
Oct. 8	118.12	63.37
" 9	117.87	63.00
" 10	117.12	62.87
" 11	117.00	62.87
" 12	Sunday	
" 13	Holiday	
" 14	117.12	62.06

Average week ending	Cents	Pence
Sept. 2	111.45	58.93
" 9	111.99	60.96
" 16	112.77	61.14
" 23	114.10	62.04
" 30	117.70	63.14
Oct. 7	119.56	63.71
" 14	117.44	62.83

Monthly averages

	1917	1918	1919
Jan.	75.14	88.72	101.12
Feb.	77.54	85.79	101.12
Mch.	74.13	88.11	101.12
Apr.	72.51	95.35	101.12
May	74.61	99.50	107.23
June	76.44	99.50	110.50
July	78.92	99.62	106.36
Aug.	85.40	100.31	111.35
Sept.	100.73	101.12	113.92
Oct.	87.38	101.12	....
Nov.	85.97	101.12	....
Dec.	85.97	101.12	....

COPPER

Prices of electrolytic in New York, in cents per pound.

Date	
Oct. 8	21.25
" 9	21.50
" 10	21.75
" 11	22.00
" 12	Sunday
" 13	Holiday
" 14	22.12

Average week ending	
Sept. 2	22.55
" 9	22.37
" 16	22.29
" 23	22.10
" 30	21.58
Oct. 7	21.35
" 14	21.72

Monthly averages

	1917	1918	1919
Jan.	29.53	23.50	20.43
Feb.	34.57	23.50	17.34
Mch.	36.00	23.50	15.05
Apr.	33.15	23.50	15.23
May	31.69	23.50	15.91
June	32.57	23.50	17.53
July	29.07	26.00	20.82
Aug.	27.42	26.00	22.51
Sept.	25.11	26.00	22.10
Oct.	23.50	26.00	....
Nov.	23.50	26.00	....
Dec.	23.50	26.00	....

LEAD

Lead is quoted in cents per pound, New York delivery.

Date	
Oct. 8	6.25
9	6.25
10	6.25
11	6.25
12	Sunday
13	Holiday
14	6.25

Average week ending	
Sept. 2	5.90
" 9	5.83
" 16	5.97
" 23	6.20
" 30	6.07
Oct. 7	6.16
" 14	6.25

Monthly averages

	1917	1918	1919
Jan.	7.64	6.85	5.60
Feb.	9.10	7.07	5.13
Mch.	10.07	7.26	5.24
Apr.	9.38	6.99	5.05
May	10.29	6.88	5.04
June	11.74	7.59	5.32
July	10.93	8.03	5.53
Aug.	10.75	8.05	5.78
Sept.	9.07	8.05	6.02
Oct.	6.97	8.05	....
Nov.	6.38	8.05	....
Dec.	6.49	6.90	....

TIN

Prices in New York, in cents per pound:

Monthly averages

	1917	1918	1919
Jan.	44.10	85.13	71.50
Feb.	51.47	85.00	72.44
Mch.	54.27	85.00	72.50
Apr.	55.63	88.53	72.50
May	63.21	100.01	72.50
June	61.93	91.00	71.83
July	62.60	93.00	70.11
Aug.	62.53	91.33	62.20
Sept.	61.54	80.40	55.79
Oct.	62.24	78.82	....
Nov.	74.18	73.67	....
Dec.	85.00	71.52	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery in cents per pound:

Date	
Oct. 8	7.70
9	7.70
10	7.70
11	7.75
12	Sunday
13	Holiday
14	7.75

Average week ending	
Sept. 2	7.89
" 9	7.76
" 16	7.62
" 23	7.50
" 30	7.38
Oct. 7	7.46
" 14	7.72

Monthly averages

	1917	1918	1919
Jan.	9.75	7.78	7.44
Feb.	10.45	7.97	6.71
Mch.	10.78	7.67	6.53
Apr.	10.20	7.04	6.49
May	9.41	7.92	6.43
June	9.63	7.92	6.91
July	8.98	8.72	7.78
Aug.	8.58	8.78	7.81
Sept.	8.33	9.58	7.57
Oct.	8.32	9.11	....
Nov.	7.78	8.75	....
Dec.	7.84	8.49	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. Prices, in dollars per flask of 75 pounds:

Date	
Sept. 16	105.00
" 23	105.00
" 30	105.00
Oct. 7	95.00
" 14	85.00

Monthly averages

	1917	1918	1919
Jan.	81.00	128.06	103.75
Feb.	126.25	118.00	90.00
Mch.	113.75	112.00	72.80
Apr.	114.50	115.00	73.12
May	104.00	110.00	84.80
June	85.50	112.00	94.40
July	102.00	120.00	100.00
Aug.	115.00	120.00	103.00
Sept.	112.00	120.00	102.60
Oct.	102.00	120.00	....
Nov.	102.50	120.00	....
Dec.	117.42	115.00	....

MONEY AND EXCHANGE

Foreign exchange remains sensitive and irregular, without much evidence to account for its fluctuations.

Publication by the Treasury of a revised list of credits advanced by the Allies shows the large accommodations which have been granted since ending of hostilities. From the Armistice to September 22 the Treasury has made advances of $2,229,502,209. In the first seven months following the Armistice credits were extended in a large degree to allow the Allies to purchase foodstuffs and raw materials in this country to restore their depleted stocks and advances averaged $280,117,180 a month. Advances since the Armistice, up to and including September 22, are shown in the following:

November	$209,249,697
December	389,052,000
January	290,250,800
February	145,397,302
March	322,350,000
April	409,608,608
May	$194,911,857
June	54,750,000
July	97,650,000
August	54,275,945
September	62,006,000
Total	$2,229,502,209

Of credits granted since the entrance of this country into the War Treasury statements show re-payments have been made as follows: May, $7,570,000; July, $10,000; and August, $26,577,000, a total of $34,157,000. In addition there have been some re-payments in September, but definite figures have not been announced. Announcement by Secretary Glass that an agreement has been reached providing for funding of the $500,000,000 yearly interest on loans to the Allies indicates that large re-payments at this time cannot be expected.

A Paris cable says $90,500,000 increase in Bank of France circulating notes is due to payments to inhabitants of devastated regions. Since June 30, paper circulated by the Bank of France increased $350,000,000, and since the Armistice $1,100,000,000. In 1914, $1,300,000,000 was outstanding with $925,000,000 gold cover, or 71%. Now has $7,000,000,000 out, with $1,075,000,000 gold cover, or 15%. Bankers had previously regarded this increase as expansion, but they now believe the issues were against indemnity due the inhabitants of the devastated regions. Many French financiers favor the issue of a Government loan purchasable only in Bank of France notes, these notes to be retired, thus cutting down outstanding paper. What bankers regarded as a praiseworthy effort of the German Reichsbank to cut down paper issue is now shown to be simply a retirement of marks in Alsace-Lorraine and Belgium by French money. Bankers state the gold advance of $300,000,000 for the cover of currency of new nations would stabilize currency of all Eastern Europe.

An advance in federal reserve bank discount rates is likely before long. It is an entirely anomalous situation in the money market today, when banks are able to secure 10%, 12% and 15% for call money at the same time that they obtain advances from federal reserve banks at 4% for 15 days, and re-discounts up to 90 days at 4¼% on security of United States government war obligations. Discount rates will probably be raised about October 24, when loans that the banks made to customers to carry subscriptions on the Fourth Liberty Loan, which they agreed to do for a year at the bond rate, expire. When re-discount rates are raised the federal reserve institutions will begin functioning in a proper manner in the money market.

Quotations on October 14 are as follows:

Sterling:	Cable	4.19
	Demand	4.18½
Francs:	Cable	8.64
	Demand	8.66
Lire:	Demand	9.95
Marks		4.00

Eastern Metal Market

New York, October 8.

There is very little change in the general situation. Business is more or less at a standstill. With the steel and other strikes, buying is mostly hand to mouth and general quietness is expected to prevail until there is some definite and clear-cut outlook into the future.

The copper market has been quiet with a slight easing in prices by outside interests.

Although the tin market is not active it is firm and fairly strong.

The lead market, while inactive, has a strong undertone and prices are firm.

Prices of zinc have advanced sharply in the last two days and buying is better.

There is no change in antimony.

IRON AND STEEL

It is generally conceded that the back of the steel strike has been broken but that a return to normal conditions will be slow. It is likely to be largely a sellers' market from now on or at least for a time. Large producers are expected to hold down prices. Premiums rule for prompt shipment and no cancellations have been received even by mills that are shut up tight. Pig-iron output in September, according to the blast-furnace reports of 'The Iron Age', was 2,441,554 tons, or 301,834 tons less than August, which had 31 days. It was, however, larger than July's output of 2,428,541 tons. The daily average in September was 81,385 tons against 88,496 tons and 78,340 tons in August and July, respectively. The effect of the strike is shown by a net loss of 103 furnaces on the active list. Activity in foundry-iron is the outstanding factor. Inquiries for rails for next year are prominent. Pittsburgh sheet mills are operating about 70% of capacity. American prices on machine tools for a French car works totaled 1,800,000 francs, against a German offer of 450,000 francs. The French Government said the buyers were justified in going to Germany.

COPPER

What little demand exists is being satisfied largely by smaller producers and dealers in what is termed the outside market. Here electrolytic copper for early or October delivery is selling at 21.25c. to 21.50c., New York, with near future position about ¼c. higher. Lake copper in this market is about 21.50c. to 22c., New York. Large producers continue to maintain their prices at 23.50c., New York, for both Lake and electrolytic. Little business is reported in the last week from any source, domestic or foreign. The steel strike is having its effect in this market but to a rather small degree. Domestic consumption on the whole is decreasing rather than otherwise. Estimates place the output of domestic smelters at about 100,000,000 lb. per month. Japan continues to take considerable copper. Oriental shipments, including China, have been 10,285 tons on the last 60 days. It is calculated that total exports for September will have been about 45,000,000 pounds.

TIN

The market is quiet. A fairly good business was done last week in future shipment from the East at around 53c., but very little spot tin has been reported sold, the quotation for which yesterday was 55.25c., New York. In the last ten days the entire market has been very dull with practically no sales of future shipments heard of. The advance of nearly £5 per ton in the London market has, however, had its effect here so that prices are nominally higher and firm. This has been caused over there by the better feeling due to a termination of the British railroad strike, but it is believed the advance has been too rapid as a whole. An interesting fact is that the 'Homestead', which arrived last week, had aboard 2250 tons of Straits tin, all from the Far East, the largest consignment ever to arrive on one vessel. The 'Gaelic Prince,' due this week, is said to have on board 1350 tons, making the total arrivals very large in so short a period. This has had a sentimental effect on the market. Total arrivals this month have been 1880 tons. Total arrivals in September were 4825 tons, of which 1725 tons came in at Pacific ports. Stocks and landing on September 30 were 1515 tons. Total imports for the year to October 1 have been only 16,976 tons, as against 44,837 tons in the same nine months of 1918. The quantity of tin afloat on October 6 was 7985 tons. Shipments from England recently have been almost nothing, due to the railroad strike over there. Despite the large tin arrivals here it is not believed that much of this is being re-sold by consumers to whom it is consigned. American electrolytic is reported as offered at lower prices than Straits or pure English tin, but just what these prices are it is difficult to learn. One quotation for the American tin is 54.87½c., New York, with 99% pure held at 54.25c. to 54.50c.

LEAD

There has been little change in the lead situation in the last week. It is claimed that the outside lots have been pretty well absorbed with the lowest price now at about 6.15c., New York. The American Smelting & Refining Co. still maintains its price at 6c., St. Louis, and 6.25c., New York. We quote the general market at 6.20c., New York, and 5.95c., St. Louis, for October delivery, the latter position being firm, and higher relatively than its Eastern market.

ZINC

This market is the only one that is distinctly higher. Prime Western for October or early delivery was quoted yesterday at 7.37½c., St. Louis, or 7.72½c., New York, an advance of ⅝c. over a week ago. The principal cause is the general recognition of the fact that the steel strike, in galvanizing centres at least, is a failure. Galvanizers have become more interested in the market and dealers and some operators have been buyers. These two factors have been the cause of the higher prices. As to exports, the situation is more favorable because of the settlement of the British railroad strike, releasing ships held up in American ports.

ANTIMONY

Demand is light and the market is dull and unchanged at 8.50c. to 8.75c., New York, duty paid, for wholesale lots for early delivery.

ALUMINUM

No. 1 virgin metal, 98 to 99% pure, is unchanged at 32c. to 33c., New York, for wholesale lots for early delivery.

ORES

Tungsten: Business is at a standstill, both because of the strike and because of the tariff controversy. Resolutions against the tariff bill as passed by the House were adopted recently at a meeting in New York.

Molybdenum: Some business is reported at 75c. per lb. of MoS_2 in regular concentrates, but the market is not lively.

Manganese-Iron Alloys: Some British producers are quoting $100, seaboard, for 76 to 80% alloy, for delivery the remainder of this year, while others are still asking $105 to $110. The market is quiet. Spiegeleisen is quoted at $35, furnace, but this could perhaps be shaded.

Book Reviews

Lecture Demonstrations in Physical Chemistry. By Henry S. Van Klooster. Pp. 189, ill., index. The Chemical Publishing Co., Easton, Pennsylvania. For sale by 'Mining and Scientific Press'. Price, $2.

This book consists mainly of descriptions of various 'experiments' that can be used to illustrate classroom lectures on the various phenomena of physical chemistry. The subjects treated include osmosis, diffusion, vapor pressure, catalysis, the ionic theory and other branches of electrochemistry, solubility, adsorption, actino-chemistry, combustion, and explosion. The book will appeal to the professor teaching these subjects and possibly to the person with a dilletante interest in the same. Supplemented by a good textbook it might be used to advantage by the student.

Model Making. Edited by Raymond F. Yates. Pp. 379, ill., index. The Norman W. Henley Publishing Co., New York. For sale by 'Mining and Scientific Press'. Price, $3.

Those who have associated model-making with toy-making will be enlightened to learn from a perusal of this book of the importance of the pursuit. About one-third of the book is devoted to the equipment and processes used in model-making, some of the subjects discussed being the workshop in general, lathes, drills, soldering, tempering and hardening steel, abrasives, pattern-making, and electroplating. The remainder of the book discusses the construction of various kinds of models, among them being several steam-engines, an aeroplane, a steam-turbine, a steam-boiler, several vessels, a crane, a gasoline engine, an electric-locomotive, and a steam-locomotive. The book is illustrated with over 200 photographs and line-drawings. It will be of value to those who are interested in model-making.

Liquid Fuels for Internal-Combustion Engines. By Harold Moore. Pp. 191, ill., index. D. Van Nostrand Co., New York. For sale by 'Mining and Scientific Press'. Price, $5.

This book is divided into three parts. Part I discusses the different liquid fuels, including petroleum, shale-oil, and the various tar-oils, as well as the less important alcohols, animal and vegetable oils, and the products of the distillation of wood and peat. Part II classifies these oils according to their suitability for engines with carbureters and for Diesel and semi-Diesel engines with atomizers or vaporizers. Part III discusses the examination and testing of fuel-oils. An appendix contains a brief glossary, several sets of specifications, and some statistical and mathematical tables. The book is written from the viewpoint of the British user of fuel-oil, which interferes somewhat with its usefulness to the American reader. However, the American engineer whose interest in the subject is sufficient to counterbalance the relatively high price asked for the book will find it of value.

Petroleum. By Albert Lidgett. Pp. 165, ill., index. Isaac Pitman & Sons, London and New York. For sale by 'Mining and Scientific Press'. Price, $1.

This is an attempt in a 'popular' book to cover, for the entire world, the various aspects of petroleum, including production, transportation, refining, and use. Naturally, the author's material, when spread out so thin, develops cracks in a few places. The book is written from the British standpoint, and is probably more accurate where discussing conditions in Great Britain and the British Empire generally than in other places. While some inaccuracies are, as already pointed out, probably the result of an attempt to cover too wide a field, there are others that are caused simply by hasty composition. For instance on page 159, the estimated production of petroleum in Russia in 1917 is given as 69,000,000 bbl., while on page 165 it is given without any qualifying foot-note as 34,700,000 bbl. Nevertheless, the principal statements of fact in the book are correct, and the layman that wishes to learn these principal facts will find it of value. The man that wishes to study the subject thoroughly had better use a book not quite so popular in its treatment.

Walls, Bins, and Grain Elevators. By Milo S. Ketchum. Third edition. Pp. 546, ill., index. McGraw-Hill Book Co., Inc., New York. For sale by 'Mining and Scientific Press'. Price, $4.

It is seven years since the second edition of Professor Ketchum's standard treatise appeared. The principal new material to be found in this edition includes data on the economic design of reinforced concrete retaining-walls, formulas for wedge-shaped reinforced concrete beams, formulas for calculating the load on bin-walls, the calculation of pressures in sand-boxes, problems fully worked out in the design of retaining-walls and bins, and the report on the design of retaining-walls adopted by the American Railway Engineering Association. In addition, there have been a number of minor changes. The book considers the design and construction of walls, bins, and elevators constructed of various materials, together with cost data and descriptions of actual structures. Like the previous editions, the treatise will prove a necessity for anyone engaged in that class of work.

Recent Publications

Fuller's Earth in 1918. By Jefferson Middleton, II:6, U. S. Geological Survey, 1919. Pp. 6. From Mineral Resources of the United States, 1919—Part II.

Salt, Bromine, and Calcium Chloride in 1918. By Ralph W. Stone. II:5, U. S. Geological Survey, 1919. Pp. 18. From Mineral Resources of the United States, 1918—Part II.

Prices of Coal and Coke, 1913-1918. By C. E. Lesher. Prepared in co-operation with the U. S. Fuel Administration and War Industries Board, II:4, U. S. Geological Survey, 1919. Pp. 100. From Mineral Resources of the United States, 1918—Part II.

Burning Steam Sizes of Anthracite With or Without Admixture of Soft Coal. Reprint of Engineering Bull. 5. Prepared by the U. S. Fuel Administration in collaboration with the Bureau of Mines. Technical Paper 220, U. S. Bureau of Mines, 1919. Pp. 8.

Twenty-Eighth Annual Report of the Ontario Bureau of Mines, 1919. Vol. XXVIII, Part II. **Abitibi-Night Hawk Gold Area.** By C. W. Knight, A. G. Burrows, P. E. Hopkins, and A. L. Parsons. **Larder Lake Gold Area.** By P. E. Hopkins. Published by A. T. Wilgress, Toronto, 1919. Ill., map, index.

Upper Cretaceous Floras of the Eastern Gulf Region in Tennessee, Mississippi, Alabama, and Georgia. By Edward Wilber Berry. Professional Paper 112, U. S. Geological Survey, 1919. Pp. 177, ill., map, index. For sale by Superintendent of Documents, Government Printing Office, Washington, D. C. Price, 50 cents.

Physical and Chemical Tests on the Commercial Marbles of the United States. By D. W. Kessler, Assistant Engineer Physicist, Bureau of Standards. Technologic Paper of the Bureau of Standards No. 123, Department of Commerce, 1919. Pp. 54, ill. For sale by Superintendent of Documents, Government Printing Office, Washington, D. C. Price, 15 cents.

INFORMATION FURNISHED BY MANUFACTURERS

MOTOR-TRUCK FREIGHT AND OPERATING COSTS

By R. E. Fulton*

In handling freight by motor-trucks two principles are involved: first, service; second, cost. Every question in connection with the use of motor-trucks falls under one or the other of these heads.

In comparing railway freight-charges with motor-truck freight-charges it is necessary to include all the incidental items of expense connected with them. Sometimes manufacturers figure that a railway freight-rate of 50c. per hundred pounds is cheaper than a motor-truck freight-rate of 75c. per hundred pounds between the same points, whereas the freight-rate of 50c. does not include the expense of making the shipment, which starts with the boxing or packing cost, and incurs many other expenses until delivery is made to the receiver in good order.

The general traffic manager of one of the largest manufacturing concerns in the United States figured out what it cost them to ship freight by railroad and by motor-truck between various Eastern points. In railway freight cost he included the first-class freight-rate, by which their goods would have to be shipped, plus 15c. per 100 lb. teaming charges from shipper's warehouse to freight house, plus 15c. per 100 lb. teaming charge from freight warehouse to receiver's warehouse, plus 24c. per 100 lb. to cover increased cost of boxing and extra freight caused by the increased weight of heavier boxes.

Without including several other items of expense, this gave the following table of comparative freight-rates per 100 lb.

From	To	Via freight	Via motor truck
[illegible]	New York	$1.04	$0.20
New York	Newark	0.91	0.15
	Passaic	0.91	0.18
	Paterson	0.91	0.20
	Elizabeth	0.91	0.20
	New Brunswick	0.91	0.40
	Trenton	0.98	0.60
	Philadelphia	1.02	0.80
	Chester, Pa.	1.05	1.00
	Wilmington	1.13	1.20
	Coatesville	1.15	1.05
	Port Chester	1.02	0.63
	Greenwich, Conn.	1.02	0.63
	Stamford, Conn.	1.03	0.65
	Norwalk, Conn.	1.06	0.68
	Bridgeport	1.10	0.70
	New Haven	1.13	0.73
	Derby, Conn.	1.13	0.73
	Ansonia, Conn.	1.13	0.73
	Shelton, Conn.	1.13	0.73
	Naugatuck, Conn.	1.15	0.74
	Waterbury	1.16	0.75
	Meriden, Conn.	1.16	0.75
	Hartford, Conn.	1.21	0.90
	Springfield, Mass.	1.25	1.00
	Holyoke, Mass.	1.25	1.10
	Worcester, Mass.	1.41	1.50
	Boston, Mass.	1.36	1.50
	Providence, R. I.	1.22	1.10

In addition to this, it is necessary in practically every case to prepare material for freight shipment in an entirely different way than when it is shipped by motor-truck direct from shipper to receiver. There is a considerable additional expense for crating or other means taken to prevent loss or damage in transit. This extra expense is necessary because of the number of handlings less than carload shipments receive at the hands of the teamsters and carriers after the material leaves the shipping department. This increased protection and expense can be greatly reduced if shipments are made by motor-truck, as the packages only need protection for loading at shipper's warehouse, in transit without transfer, and unloading at receiver's warehouse. Then in shipping by motor-truck, instead of by rail, a great amount of clerical work in the form of extra bookkeeping, billing, etc., is eliminated. Where extra packing is necessary extra room is required for the boxing department. Then if railway freight shipments are delayed there is the additional trouble of tracing them. If the shipment arrives in damaged condition there is the further difficulty of collecting from the railroad company.

Contrasted to this is the example of Marshall Field & Co., who guarantee to make delivery within 50 miles of their store within 24 hours, so well is their motor transportation system organized.

Boxing often carries from 10% to 20% of its weight in moisture, unless it is kiln dried prior to boxing. The Otis Elevator Co. estimates that by the use of motor trucks it saves more than $100,000 per year in lumber alone.

Delivery time is all in favor of the motor-truck, and if manufacturers will take into account all the costs and charges which are part of true freight transportation costs, they will find that motor-trucks can be operated successfully and economically in competition with railways for distances between 10 and 125 miles.

In figuring the cost of operating motor-trucks many of the systems in use are faulty, and thus overlook items that find their way into the expense account and often cause considerable loss. The following items indicate headings under which costs should be determined for each truck:

Data: working days per year; miles per day; miles per year; miles life of car.

Investment: chassis with standard equipment; body.

Fixed charges: interest on investment; insurance; fixed depreciation (exclusive of tires); wages; garage rent.

Operating charges: maintenance; tires; gasoline; oil and grease.

Total cost per annum; total cost per day; total cost per ton-mile.

Often trucks will do unusual mileage at surprisingly small costs for repairs. We frequently get letters about Mack trucks that have given exceptional service. One of these unusual cases is that of the 2-ton Mack operated by M. Mauro of Plainfield, New Jersey, which has traveled 45,000 miles with practically no expense for repairs. Another Mack in the service of the List Brewing Co. of Plattsville, Wisconsin, has traveled 30,000 miles and the only repair expense incurred was $65 because the driver allowed the motor to freeze last winter. Such remarkable service as this cannot always be expected; but these instances serve to show the possibilities of a good truck if given reasonable care.

*Vice-president, International Motor Co.

GARFORD TRUCK HAULS LOCOMOTIVE

Proof that a motor truck of modern design and construction is capable of most any transportation task is shown by the accompanying illustration, which shows a Garford 10-ton

Garford 10-Ton Tractor Carrying Logging Locomotive

tractor transporting, with the aid of a trailer, one of the big logging locomotives used in the lumber camps of the North-West. The locomotive is the property of the Clipper Shingle Co., of Bellingham, Washington.

The company found it necessary to move this locomotive from one of its timber claims to another between which there was no connecting railroad. With the aid of a derrick the locomotive was lifted from its trucks, mounted upon the Garford tractor and the trailer and hauled over the rough forest roads to the scene of its future operations.

SHORTAGE OF RAILROAD CARS INCREASE SALE OF MOTOR-TRUCKS

The shortage of railroad cars, which is beginning to be seriously felt in many parts of the country, has already had its effect upon the sales of motor-trucks. In August the sale of Mack trucks alone increased 64% over those for July, and the sales for September continue at the same high rate. The large proportion of sales of heavy-duty trucks indicates that the buyers purchased trucks to enable them to haul large quantities of material that they evidently feel they cannot count on the railroads to handle.

Commenting on the situation, R. E. Fulton, vice-president of the International Motor Co., said: "There is just one solution to our present industrial troubles, and that is the production of necessary supplies on the largest scale possible, and their prompt, thorough, and efficient distribution. Through its transportation efficiency and economy, the motor-truck is giving material aid in advancing both production and distribution. Reliance on motor-trucks will become more imperative with the coming of cold and unfavorable weather."

FIRST CALIFORNIA HIGHWAY MOTOR TRAIN

Under the auspices of the San Francisco Motor Truck Distributors there started from San Francisco on September 25, what is known as the First California Highway Motor Train. This train is to proceed to Los Angeles, stopping at all of the larger cities en route and will be composed entirely of trucks carrying freight for delivery to Los Angeles merchants. The 'ship by truck' idea has been gaining in prominence for some time, particularly in California, where there has grown up a network of efficiently operated automobile stage and truck lines. Truck transportation brings in a new era of moving goods, in which the motor-truck stands shoulder-to-shoulder with steam in national commerce.

Entries for the motor train were confined to distributors, or in the absence of available units for entry, the dealer or distributor was permitted to enter owner's trucks. The convoy is under the direction of a train commander, and for this purpose L. A. Nares, former president of the State Automobile Association, and a prominent 'good roads' man, was chosen. Mr. Nares will make addresses at the various cities on the subject of good roads, and other speakers will put forth the doctrine of 'ship by truck'.

Lavish entertainment will be furnished en route. On arriving in Los Angeles a banquet will be tendered by the automobile interests there to those who have made the trip. A fleet of trucks will meet the San Francisco train some distance from Los Angeles and escort them to the city.

It is expected that this will be the first of many similar trips of this sort and that the increase in truck movement of freight will parallel highway development throughout California and the Nation.

ORONITE ROOF PAINTS MAKE ROOFS LIVE LONGER

The roof of a building is undoubtedly its most vital part; it has often been said that a structure is only as good as its roof. In order to protect the contents of the building the roof must be kept in perfect repair, and a good paint, such as Oronite roof paint, has been proved the best means of obtaining this object in the case of most types of roofs. Many industrial plants are using Oronite roof paints not only for painting both metal and prepared roofing, but also as a protective coating in all cases where an extra heavy or thick coating is necessary. Other plants are using this paint for repairing old paper roofs that have got into bad condition. In this connection it has given perfect satisfaction when used for patching holes in old roofs. Not only has Oronite roof paint been widely used as a preservative coating on top of new and old roofs covered with ready roofing, but it has also been found an excellent binder between and on top of roofing felt and ready roofing, forming what is commonly known as 'built-up' roofing.

This paint possesses certain qualities which have made it useful in many other ways than on roofs. It is suitable for patching tennis courts and paths when mixed cold with mineral aggregate. A certain sugar company in California uses Oronite roof paint on pipe-lines at its plant with excellent results. A copper company in Arizona is using it for protecting fuses in wet holes. The company states that it is the best material it has ever found for the purpose, as there has not been a missed shot since its use. Another use of Oronite, and one for which it is excellently suited, is on cuts, abrasions, and wounds of trees. Many municipalities are employing it for this purpose.

Oronite roof paint is one of the most useful of the different kinds of Oronite paints. Its high quality and many other advantages make it a necessity wherever a preservative paint is needed.

TRAILERS AND TRAILER PARTS NOT TAXABLE UNDER REVENUE ACT

Regulations No. 47 relating to excise taxes states in Article No. 12:

"Automobile trucks and automobile wagons: The tax is 3% of the price for which automobile trucks and automobile wagons are sold by the manufacturer. An automobile truck or automobile wagon is a self-propelling vehicle primarily designed or adapted for the transportation of property. The act specifically exempts tractors, even if sold in combination with a trailer."

Article No. 16 further states:

"Automobile trailers, regardless of the number of wheels

which they may have, are not parts of or accessories for automobiles; but rear portions of automobile trucks, automobile wagons, or other automobiles, not properly called trailers, are taxable as a part of the automobile."

The last sentence relating to rear portions of automobile trucks is supposed to refer to truck units.

PRINCE OF WALES VISITS SULLIVAN DRILL

In June of this year the Prince of Wales, who is also the Duke of Cornwall and Devonshire, visited the Kit Hill mine in Cornwall, and was much interested in the operation of a Sullivan diamond-drill. Because of the enterprise of the Duchy management in installing up-to-date machinery, these mines are providing valuable quantities of tin and wolfram, the supplies of the latter having proved of great national service during the War. The new Sullivan diamond-drill, which began its work of boring on May 28, takes out a 1-in. core. The average speed is 12 ft. per day for horizontal holes in single shifts. The Prince spent some time watching the drill at work and displayed a keen interest, asking many questions relative to the mechanism.

COMMERCIAL PARAGRAPHS

Frank O'Ryan has been appointed district manager for the **Allis-Chalmers Mfg. Co.**, Denver, Colorado.

During July of this year exports of pumps and pumping machinery from the United States amounted to $671,047. In the same period the exports of mining machinery totaled $653,286.

The Albert P. Hill Co., Inc., of Pittsburgh, Pennsylvania, announce that their offices have been moved from the Peoples Bank Bdg. to new and larger quarters, the entire top floor of 233 Oliver Ave., where their growing business will be taken care of with enlarged facilities.

On October 1 the **Chicago Pneumatic Tool Co.** will remove its Birmingham office from 801 Brown Marx Bdg., Chicago, to 1926 Fifth Ave., North, where a service station with a complete stock of pneumatic tools, electric tools, air-compressors, oil-engines, rock-drills, and repair parts will be maintained.

The Consolidated Mining & Smelting Co. of Canada announces that on and after October 6, 1919, the head office and general sales office will be in the Drummond Bdg., 511 St. Catherine St. West, Montreal. The Ontario sales office will be continued in the Canadian Pacific Railway Bdg., 69 Yonge St., Toronto.

A reprint of **Allis-Chalmers** bulletin No. 1411 on modern rock-crushing plants has just come from the press. Gates gyratory crushers, revolving screens, and elevators, with accessory parts, are taken up in order, followed by detailed drawings in plan and section of numerous rock-crushing plants of approved design in operation in various parts of the country.

Earl E. Eby, sales manager for the **Hyatt Roller Bearing Co.**, Industrial Bearings Division, has been appointed to the board of directors of Hyatt, Ltd., a new company formed to market the Hyatt bearing in Europe. Mr. Eby will devote his entire time to this work with headquarters in New York. G. O. Helmstaedter, formerly Chicago district manager, has been promoted to the position of sales manager to fill the vacancy.

Ernesto Barrentes, ship engineer for Alberto Fait & Co. of Puntarenas, Costa Rica, recently arrived in the United States where he is inspecting oil engines to be used in marine work. Fait & Co. purchased a number of 75-hp. 'Western' Diesel engines manufactured by the **Western Machinery Co.** of Los Angeles, a short time ago, for use in its 300-ton boat 'Rossini', and Mr. Barrentas' trip primarily is for the purpose of working on these engines during the process of manufacture so as to become thoroughly familiar with their construction and operation, and also to secure delivery of the engines at the earliest possible moment. The 'Western' engines purchased by the Fait company are vertical, single acting, four-cycle, enclosed crank case, medium speed, heavy-oil type, three cylinders of 25 hp. each. These engines are being used in many parts of the world now, according to the Western Machinery Co., which states they are adaptable to all power purposes.

The Lidgerwood Mfg. Co., of New York, announces the opening of a branch office in the Hammond Bdg., Detroit, Michigan, for the sale of its contractors hoists, derricks, and cableways, mine hoists, ship's winches and steeering gear, and logging machinery. R. S. Hutchinson, formerly of the Lidgerwood office in Philadelphia, will have charge of the Detroit office, under the direction of F. B. Knight of the Lidgerwood Chicago office, who previously handled this business in Detroit.

Announcement is made by the **Williamsport Wire Rope Co.**, Williamsport, Pennsylvania, of the establishment of a branch office and warehouse at Chicago under the direction of C. M. Ballard, formerly connected with the Williamsport organization at Cleveland, Ohio. The Chicago office is at 122 South Michigan avenue and the warehouse at 755 West Quincy street. This new Chicago branch is the latest step in the development of the Williamsport's distribution organization. Increased demand in the Middle West for a wire rope made by a concern which draws its own wire and therefore controls the quality of every grade of its product, has made possible this improvement in service to the Chicago district. The new warehouse carries one of the largest and most complete lines to be found anywhere. It is stocked with every kind of rope manufactured by the Williamsport company, with the result that the concern now can guarantee immediate shipment from Chicago to customers in the territory served from that point.

A. A. Schneider, formerly with the raw materials department of the Midvale Steel & Ordnance Co. and Cambria Steel Co., has been apointed manager of the newly created raw materials division of the **American Steel Export Co.** Prior to entering military service in 1917 as a Lieutenant of Field Artillery, Mr. Schneider had, for several years, been assistant to H. F. Black of the Midvale and Cambria companies of Pittsburgh, and carries with him to his new post a wide experience in, as well as a large acquaintance with, the raw materials and metals trades. In his new field, Mr. Schneider will handle imports, exports, and domestic sales of pig-iron, manganese, chrome, and low phosphorus iron-ores, ferro-alloys, coal, and coke. Although the development of markets for these commodities, particularly in foreign fields, is a new undertaking for the American Steel Export Co., the volume of recent over-seas inquiries, particularly on irons, renders the outlook for the immediate future optimistic.

The Denver, Boulder & Western R. R. has been purchased by the **Morse Bros. Machinery & Supply Co.**, of Denver. This road, 49 miles in length, situated in Boulder county, connects Ward and Eldora with Boulder, and is the outlet for practically all the mining towns and districts in Boulder county. It is a narrow-gauge line, laid with 56-lb. rail, and is completely equipped with 8 locomotives, 90 freight cars, passenger coaches, etc. The Morse Bros. company has offered this road to the mining men and commercial organizations of Boulder county, at a price considerably below its scrap value in order that the road may remain and be of service to the community. An earnest effort is being made by these organizations to save the road from being taken up. The cost of the road was considerably over a million dollars. Permission has been given the owners by the Public Utilities Commission of Colorado to dismantle the road, which will be done at once in case the Boulder organizations and men are not sufficiently interested to save it.

OUR contemporary in New York is compelled to replace its usual issue with an emergency bulletin of four pages, on account of the printers' strike, which has stopped the publication of some two hundred periodicals in New York. In the latest of these bulletins, the new editor of the 'Engineering and Mining Journal' prints his salutatory, which we find interesting. We extend our sympathy to Mr. J. E. Spurr in having to start his career as an editor under such untoward circumstances. The strike in New York can benefit nobody; it is an intolerable outrage, against which the public should support the publishers wholeheartedly.

STATISTICS are synonymous with verbal inexactitudes. We read in the 'Saturday Evening Post' that according to the new edition of Lloyd's Register, Great Britain lost 2½ million tons of shipping between June 1914 and June 1919; on the same day we read a cablegram from London appearing in the daily press stating officially that Great Britain lost 7,759,090 gross tons of merchant shipping during the War, and that, of this total, 6,635,059 tons was lost by submarine attacks. Also that 14,287 lives were sacrificed. Incidentally, these figures testify once more to the tremendous losses incurred, in life and material, by England in the war with the Hun.

THEODORE PRICE, a press economist of recognized standing, has computed that the combined effects of war, influenza, the adoption of the shorter working day, and the prevalent strikes have caused a decrease, since July 1914, of 40% in the world's output of the things that are necessary. This would account for the high cost of living, but to it we must add the increase of luxury among the laboring classes as their wages have increased and the extravagance of those who made money by profiteering during the War. This free spending of money among those to whom the War was a cause not of misfortune, but of fortune, is a glaring fact as much in Paris as in New York, in London as in San Francisco. It should be condemned by all good citizens.

"PEACE hath her victories no less renowned than War" and men of peace are privileged sometimes to receive the acclaim of marshalled legions. On Mr. Hoover's last visit to Warsaw the Poles desired to do honor to him and to express their gratitude to the United States for food and other economic aid so freely given. Mr. Hoover and his commission were called upon to review a procession of 45,000 children, barefooted and in tatters, but each carrying an American flag in paper. They walked past for seven hours and then the police had to stop the procession. General Henri, a French officer present on the occasion, said that he would rather have received the salute from that army of children than from any army that had been formed in the Great War. May those children live to love in their manhood and womanhood the American flag, and may our great exponent of economic strategy live to see a happy and contented Poland.

NOVEMBER 1 is the date set for a general strike in all the bituminous coalfields. The strike has been called by the United Mine Workers of America in order to enforce a new scale of wages in the central competitive coal district. An agreement exists between the workers and the companies, and it does not expire until April next, yet the labor agitators ignore it, making demands so excessive as to menace the very existence of the coal industry. They demand an increase of 60% in wages, a 30-hour week, 50% additional pay for over-time and 100% additional for Sundays and holidays. It is estimated that, if accepted, these demands will add $2 to $2.50 per ton to the present high cost of coal, placing an intolerable burden upon those already oppressed by the high cost of living. The threatened strike forms part of the movement among the radical and irresponsible elements of organized labor to oust their conservative leaders and to apply the teachings of the Russian revolution in this country; it is a plain defiance of public opinion and of the welfare of millions of plain people.

AMONG the undesirable terms creeping into the technology of mining is 'commercial,' as applied to payore. In a recent bulletin of the U. S. Bureau of Mines we read of "new commercial deposits," the reference being to fresh discoveries of ore or newly discovered ore deposits. The word 'commercial' in such a context pleases the promoter of wild-cats because it smacks of regular business; it suggests direct economic exchange. Ore is not an object of commerce; it has to be mined, milled, and smelted before its valuable contents are marketable in the true sense of the word. "Commercial deposits" evokes the image of the receiving teller in a bank, not a mass of metal-bearing rock, possibly in a locality far from any bank or bourse. As used by the

miner, and therefore by a Bureau of Mines, the word 'mine' connotes a profit, simply because the digging of ore is done for gain. The gentlemen of the Bureau should set a good example in these matters, not follow the bad example set by illiterate or irresponsible persons.

IT has been suggested, in the 'Manufacturers Record,' that no alien should be allowed to belong to any labor or political organization. Is not this a bit drastic? If an alien gives his work to American industry, he should be free to form any law-abiding labor organization he pleases, otherwise what happens to our ideal of an equality of opportunity? His status is that of a workman, not a citizen. Political participation is a different matter. If he is not a citizen of this country and has given no evidence of his desire to become one, by the formal declaration of his intention, he ought to abstain from interfering in affairs that are none of his. With that we agree. Failing to become a citizen, or even a near-citizen, he has only the privileges accorded to him under the treaties existing between the United States and the country of his origin; these include membership in law-abiding labor organizations, but it may be observed that they do not include participation in sabotage or in strikes that are unblushing attempts to upset American life by forcing upon us the repulsive doctrines of the anarchist. Indeed, it is high time that the political excitations of aliens were restrained and that they were prevented from disrupting American industry; but in all such matters we must be just, lest we play into the hands of the reactionary element, which is as destructive of American ideals as the anti-social forces now rampant in the United States.

FROM the Philippine Islands we have received a letter drawing our attention to a circular issued by the Army Man's Leasing Company, inviting subscriptions to stock in a company that controls the lease of a block of land in Texas that may possibly prove oil-bearing. The prospectus says plainly that the chances of making money are not limited to the finding of oil, but they lie largely in the opportunity of selling the land, now held under option, at rising prices as the drilling of a well proceeds and before this drilling has been completed. The cost of sinking this well 4000 feet is to be met by the sale of land on the outer edge of "our holdings." The morality of this may be debatable; if the facts are stated frankly and if people are willing to take part in such a gamble, it is their business, not ours; but the propriety of using army comradeship for the purpose of company promotion is another question, concerning which there can be no doubt. The promoters have secured army-lists and have written to officers, at Camp Eldridge, for example, asking them to buy stock. The directors of the company hold commissions in the Army or they held commissions recently, it is not clear which. It is asserted that "they will receive nothing but dividends on stock that they have bought and paid for until each and every stockholder has received 200% in dividends." A subscriber, a lieutenant in the Engineers, writes to us to protest against this method of solicitation. He suggests that the proposal has "all the earmarks of a wildcat." It has.

FLYING by aeroplane is a hazardous business, if one is to judge by the results of the so-called race across the continent. Out of 62 who started, 7 were killed, besides three who were not flyers. At the end of ten days, only 11 air-men had made the crossing and about twenty machines had been smashed. The winner, Lieutenant B. W. Maynard, made the round trip, from ocean to ocean, in 10 days, which is longer than it would have taken to transport him and his machine on a train from New York to San Francisco and back again. His actual flying time was about 25 hours each way. Surely the cost in human life has not been justified by the results. We note with interest that the Associated Engineers of Spokane, on October 18, passed a resolution protesting against the exhibition and asserting that the deplorable fatalities are likely to injure public confidence in legitimate aviation. A Brigadier General states solemnly that "the air derby plainly demonstrates that the isolation of the United States with respect to Asia and Europe is completely broken down." Not nearly so completely as a dozen or more aeroplanes. The whole affair was ill considered and unproductive. We hope that it will not discourage the further development of an aviation corps, alike for commercial and military purposes.

IN the 'New York Times' we find an interesting editorial article, 'Who Invented the Tanks?' Mr. Winston Churchill and Colonel I. C. Welborn, Director of the Tank Corps of the United States Army, are quoted, and it seems agreed that the idea of using the Holt farm tractor originated from "a representative of the British government" who happened to see a demonstration of the machine "in one of the large German cities about 1913." It is a matter of interest to us not only that the tractor in its agricultural phase came from Stockton, California, but that the observer who was the first to realize the practicability of using it as a moving machine-gun fort was a mining engineer, Mr. Hugh F. Marriott, formerly in South Africa and recently president of the Institution of Mining and Metallurgy, in London. General E. D. Swinton, the British officer responsible for the successful adoption of the caterpillar tractor for military purposes, has acknowledged that the idea was first suggested to him by Mr. Marriott, who, in a letter written in July 1914, told him how he had seen the tractor going over rough country and climbing "like hell". Upon the receipt of this letter Major Swinton, as he then was, set to work to devise a bullet-proof machine suitable for attack upon the German machine-gun positions, and in order to keep secret his construction of these new engines of warfare he let it be supposed that they were intended to be motor-tanks for supplying water to the troops in Egypt. When, later, holes had to be punched through the tanks in order to make way for the muzzles of the guns, it was made known that snow-plows were to be fitted to them in preparation for using them on the

Russian front, and a Russian address was stenciled on them. The secret was well kept and the Germans knew nothing about the tanks until they came lumbering upon them at Delville wood like monsters from the primeval slime.

What Shall We do With the Treaty?

In one of his recent speeches in San Francisco Mr. Hoover described the state of affairs in Poland, asserting that the conditions existing today in Kosciusko's country are typical of the plight of the other new nations created by the Peace Conference. For a century and a half the Poles have struggled to emerge from under the heel of autocratic foreign control in order to establish their independence and assert their national ideals—the ideals of liberty that they have derived largely from the United States. After the Armistice they obtained financial and economic aid—milk for the children, locomotives for the railways, men for the new government—from our people, for whom Kosciusko and other Poles fought during our own revolutionary war. Paderewski returned home inspired by American ideals and fortified by American ideas. Without sending a soldier to Poland, the United States gave powerful aid to the emancipation of the Poles. In the same way the other insurgent peoples of the little countries of Europe have been inspired by dreams of independence brought to them from across the Atlantic. "For 150 years," exclaimed Mr. Hoover, in a rare burst of emotion, "we have stimulated these peoples with ideas of freedom and democracy; shall we abandon them now?" He answered the question himself in tones of deep deliberation: "We, who have been the advocates of human liberty, cannot stand aside after inciting these peoples to self-government; we cannot desert them after we have launched this world-wide effort for freedom." Are we to wash our hands of the mess in Europe and turn our backs upon the welter of confusion and misery that has followed in the wake of the Great War? "Yes," say some. Senator Johnson has said that he does not see why this country, solvent and prosperous, should tie itself to the bankrupt countries of Europe. He does not see why, after fighting with the Allies against the Central Powers, we should bother ourselves further about the fate of our late partners in the cause to which we committed ourselves so belatedly but so decisively. He has no qualms of honor on the subject nor any idea that such a course of action may hurt not only the self-respect of the American people but their commercial prosperity also. One of our local newspapers, 'The Chronicle,' said a few days ago that "we shall doubtless get on very nicely without the Treaty," adding that "the really important thing just now is for everybody to get to productive work." The pity of it! We exported six billion dollars worth of merchandise last year, and imported three billion dollars worth; does the editor of 'The Chronicle' suppose that there will be much "productive work" if our customers are ruined and our markets destroyed? There are those who seem to argue as if the United States were an island, detached and self contained, in the midst of the Pacific Ocean. The nations of the world today are more like a shipwrecked crew on an island where they are beset by natural enemies against whom they must unite in common self-defence. A dweller in Mars or the chief dweller in Hell might well be moved to sardonic laughter if he read these admonitions of complacent and unadulterated selfishness. "It may be the best thing in the world for us to forget the whole business for a while," says the same editor. He and others like him tried to "forget" the European war until the brutal logic of events drew us into it. Does he imagine that this country can be happy and prosperous while Europe, the mother of the United States, goes down in political and economic ruin, to riot and starvation? Mr. Hoover, the most trustworthy economic authority in the world today, says, "Economic demoralization is coming to this country unless we open markets in Europe." Again: "Even if we keep our soldiers out of it, we shall not escape fearful economic losses." Unless we supply credit and raw materials to Europe, and maintain economic relations with the Old World, we shall suffer as they are suffering. Economic relations cannot be maintained until peace is established and the changes authorized by the Paris Conference are stabilized through the League of Nations. Neither the Treaty nor the Covenant is perfect, for no settlement of the post-bellum affairs of Europe, Asia, and Africa is conceivable that could please everybody concerned. If 500 selected men working for seven months did no better, what would be the result of re-drafting either the Treaty or the Covenant by the diets, parliaments, and congresses of the allied nations? Meanwhile armies are massing again on the eastern frontiers of Germany and economic chaos threatens central and eastern Europe. Cesspools of disaffection are being created, and their infection is already spreading to our industrial centres, where alien workmen, the children of Europe, are fluttering the red rag of anarchy. We cannot fumigate the breezes that blow across the Atlantic. We are part of the civilized world, recently fallen into savagery and now tottering to economic ruin. Isolation is the dream of a madman; economic detachment is the thought of a fool. "To believe that, through the breakdown of this treaty, our neighbors can return to a thirty years' war while we maintain our progress is the egotism of insanity," again says Mr. Hoover. We need not send a soldier to Europe, we need not give military aid to anybody, but we cannot draw back in vacuous aloofness from the spectacle of a world in travail. "Am I my brother's keeper?" asked the first murderer. "He passed on the other side" is recorded of the Pharisee. Shall the nation founded by the heroic soul of a Washington or the people glorified by the tender compassion of a Lincoln turn a deaf ear to the call of humanity in this dark hour? No; by the gallant dead that lie in Flanders field, No! Our Allies have ratified the Treaty; shall we, whom it affects so much less, hold back longer than they? Let us ratify the Treaty and then use the machinery of the League to remedy its defects, pulling

together in a helpful spirit of compromise to attain a settlement that shall restore the world to peaceful industry and set anew the foundations of civilization.

Class Journalism — II

In the preceding article on this subject we referred to the fact that the editors of trade and professional papers are usually recruited from the class to which the paper makes its appeal; for example, the editors of the mining journals were mining engineers before they became journalists; the editors of the electrical papers were engaged in the electrical industry before they ventured to address those specially interested in the vast business created by the application of electric power to every kind of machinery. It is the essence of class journalism that it is founded upon an experience that has been shared alike by the writer and the reader, so that mutual sympathy exists. We need not belabor this point further; it will be readily acknowledged; but we lay stress upon it in order to bring into relief the fact that the publishers of class journals are usually without such ties with their clientele. They are speculators or investors, according to the varying degrees of risk incurred in the business. They bring capital and executive ability to the publishing trade; for it is a 'trade' in so far as the making of money suffices to sustain it. It is not a 'profession', because it is not based upon a special education. That is one of the weaknesses of their position, as the controllers of class journalism. They are in touch rather with the manufacturers who advertise with them than with the class that their periodicals are aimed to please. The publishing business is speculative and it has attracted men of great force and initiative, from engine-drivers to school-teachers, to whom the printing of news and information is attractive because upon it they can build a business to which the arts of salesmanship can be applied successfully. In their natural enthusiasm for the selling of their advertising space they are prone to under-value the reading matter on which their whole commercial structure depends. They construct an elaborate selling organization to gather the fruits of the publicity offered by their papers, but under-estimate the need for supporting their selling campaign by establishing an editorial department that can 'make good' at the other end—the vital end—of their business. They put the cart before the horse; or, if you will, they paint their wagon gaily and spend money lavishly on its equipment, and then put any sort of horse between the shafts, expecting to bring a large load to market. Their advertising agents are better paid than their editors. Indeed, it is one of the anomalies of democracy that such instruments of education as newspapers and magazines should be controlled by men to whom their educative function is a matter of minor importance. That a man like Hearst should control seven newspapers and eight magazines is a satire on democratic idealism. It is likewise strange, but not objectionable in the same way, that men having no knowledge of engineering, and no particular sympathy with the engineering class, should control most of the engineering periodicals. They, as speculative publishers, have the hankering of their kind to control the field of business activity in which they are working; so, ill content with one paper, they cherish the ambition to own a string of them, with a view to ultimate monopoly in their particular field. This leads to consolidation and syndication, for the purpose of creating an artificial advantage, namely, a magnified machine-made organization and an elaborate system of solicitation for business. The system and the organization are marvelously well done, but they have the defects of their qualities. Personal character is sacrified to mass action; the soul of a man becomes the cog of a wheel. The morale of their staffs suffers, of course; for personal leadership is subordinated to committees and boards; the vast mechanism of the business is too much for personal supervision; the machine runs ruthlessly and without regard for human amenities. The fetish of bigness is an ugly monster with an umbilical eye. The syndication of class journalism has been a striking feature of the last two decades, and it bodes no good to the readers of this branch of periodical literature. Naturally, the reaction on the editorial departments has been bad. The emphasis placed on the selling organization has tended to belittle them; the speculative publisher is inclined to regard the editor as a necessary evil; he would love to do business without the fuss of preparation required to place suitable reading matter between the fore and aft sections of his advertising supplement. In consequence, the position of the editor has lost attractiveness; not many men of high character and wide experience find it comfortable to take charge of the literary portion of the publicity business. The publishers do not dictate the editorial policy, it is true, because they take too little interest in it, except when it impinges upon the self-interest of an advertiser. The editor may irritate a few readers with impunity, but he will not fail to hear from the powers above if he annoys a single advertiser by inadvertent criticism in the course of a technical article. The place given to the editor in the syndicated organization is not pleasant; he finds himself only a pinion engaging with other and larger wheels. His tenure is precarious, because it is not fixed by personal obligation; he is dealing with a machine, not a man. Unfortunately the capital involved in the publishing of a class journal nowadays is so considerable as to debar most editors from owning their own papers; the man with a literary bent and a critical faculty is not often a maker of money, and when he is, he is unlikely to be diverted to journalism. On the other hand the successful engineer, electrician, or architect is not attracted by a position that makes him a part of a commercial mechanism; he prefers consulting practice. This is where the syndicated form of class journalism is weakest; it prides itself upon the elaboration of its organization; it views with complacency the subordination of the individual to the machine; but it overlooks the fact that character is individual and the sale of publicity is the effect, not the cause, of printing the living word.

Labor Conditions in Australia

The Editor:

Sir—Having recently spent some time in Australia and New Zealand while en route from India to California, I thought that perhaps a short account of the labor conditions now prevailing at the Antipodes might interest you. I should explain that owing to the number of people waiting at Hong Kong and Shanghai to cross the Pacific I was unable to get a passage to America by that route, so I decided to proceed to Australia and take my chance of a passage from there. At the same time I knew that I was liable to be held up there by strikes and in this I was not disappointed. It took me four months to reach America from India. It happened to be the seamen's turn to take a holiday, with the result that no steamers except a few ocean liners were plying round the coast of Australia, and between Australia and New Zealand, Tasmania, Fiji, and other Pacific islands. Many New Zealanders, including returned soldiers, were stranded in Sydney and Melbourne. In addition to this, the two steamers of the Canadian-Australasian Line, being manned by Sydney crews, were laid up on their arrival from Vancouver. The steamers of the Oceanic Steamship Co., being manned by American crews, were not affected, but they were booked up months ahead. There was a scarcity of sugar, salt, etc., in Sydney and of flour and other foodstuffs in north Queensland. In these circumstances, the Queensland Government dredge was loaded with 200 tons of flour, but when she was ready to sail for northern Queensland seven of the firemen walked ashore with their kits. Mr. Hughes, the Prime Minister of Australia, was on his way back from the Peace Conference, and in his absence the Australian government seemed to be afraid to do anything toward settling the strike until it had been going on for about seven months in Queensland and four months in New South Wales and Victoria. The ships are supposed to be under the Shipping Controller, who is an Admiral. There are thousands of unemployed in Australia and surely a sufficient number of non-unionists could have been obtained who could stow cargo and fire a boiler. But Australia is so completely in the grip of the labor-unions that no one even suggested this way out of the difficulty, although it was done some years ago when the unions refused to load the transports going to Europe. Of course, the strike affected others besides the seamen and firemen, namely, ship's officers and engineers, stewards, wharf laborers, teamsters, coal miners, and smelters.

In striking, the unions were defying the law, as they were or should have been working under an award of the Arbitration Court which had not expired, and were consequently liable (in theory) to be fined. After considerable delay the Secretary of the Union, named Walsh, who is married to one of the notorious English Pankhurst family, was tried and fined $500, which he refused to pay and would not allow the Union to pay. As he still persisted in defying the law, he was fined $1000 more and awarded three months imprisonment, but without hard labor. In fact, after a short hunger strike *à la* Pankhurst he spent the time in the jail hospital where the food was better, but the strikers announced that they would not return to work until he was released. The Union and its president were also summoned, but the case against them was adjourned from week to week, and by the time the strike terminated nothing had been done. If, on the other hand, the employers had been at fault, no time would have been lost in summoning and punishing them. Such is life under a Labor government in Australia. Compulsory arbitration has had a thorough trial there and has been a complete failure. During this strike even the strikers announced that they would have nothing more to do with it, although, under Judge Higgins, the unions have almost always succeeded in getting better conditions. This time their demands included an increase of 35 shillings per month and better accommodation. As you are aware, this is not my first visit to Australia and these are not hasty impressions. I have lived there for more than ten years and in New Zealand for five years.

Owing to this strike, 25 ships belonging to the Commonwealth government were laid up in Australia at an estimated loss of $50,000 per day. The long-suffering public, of course, will have to bear this loss. One would think that in these circumstances the Government would do its best to settle the strike. I cannot imagine the American government allowing 3000 men to hold up the trade of *this* country.

After the strike had been in progress for some time the union organized gangs of strikers to go up country rabbit-catching and other parties to go out deep-sea fishing to raise money to further the good cause. Every Sunday crowds gathered in the parks to listen to loud-mouthed speakers and the hat was passed round for the benefit of the suffering wives and children of the strikers. Soup-kitchens were also opened, to enable the lawbreakers to hold out longer. Incidentally I may mention that saloons in Sydney close at 8 p. m. now.

While the shipping strike was raging there was a

miners' strike at Broken Hill, but as this is almost a chronic condition there it did not attract much notice in Sydney. All they want is a 6 hour day, 5 days a week, £6 per shift as a minimum wage for men and boys. At that time there was 100,000 tons of lead lying at the Port Pirie smelter, where most of the Broken Hill galena concentrate is smelted. This accumulation was caused by scarcity of shipping space. At the same time most of the copper mines in Australia were shut-down for the same reason or because the cost of production was too high to leave any profit. Scarcity and inefficiency of labor were chiefly responsible for this. Other companies complained that the Metals Exchange would not allow them to sell their copper.

The Mount Morgan mine shut down because they could not ship blister copper to the refinery at Port Kembla on account of the shipping strike, and it cost too much to send it by rail. The Queensland government compelled them to resume operations under threat of taking possession and working the mine itself! The Broken Hill Proprietary Co.'s iron and steel works at Newcastle, N. S. W., were shut-down because they could not get iron ore from South Australia, limestone from Tasmania, and coke from the Illawarra district of New South Wales. The electrolytic copper refinery at Port Kembla was idle because they could get no blister from Mount Morgan or Mount Lyell and the custom-smelting department was idle because no purchased ore was coming forward. This company had 12,500 tons of wire-bars and ingots worth more than £100 per ton on hand in July because it could not get permission from the Shipping Controller to ship to England, though most of it was sold to the British government. The same condition prevailed at Port Pirie and Cockle Creek as regards lead and zinc.

At the Mount Morgan mine during the last half-year, figuring on the directors' report, the cost of producing a ton of blister copper was about £143 ($610). Fortunately for them they can produce blister carrying $400 worth of gold per ton. At Wallaroo, in South Australia, costs are £90 per ton of blister copper. At Mount Morgan there was a strike because a returned soldier was given a job in the mill, although the man he displaced was given another job. The manager told them that if they didn't return to work in two days he would close the whole works down. They returned. They are just like children.

Under the coal and coke workers award, coke-wheelers get 14s. 7d. per day. Some mechanics at Port Kembla gave up their jobs to go coke-wheeling.

The State of Queensland made a loss of £1,500,000 on its railroads last year and one of the ministry (who are Irish laborites) said he didn't think they should be expected to pay. They also made a loss of £45,000 in 3½ years on the State coal mine and closed it down, but they now intend starting an iron and steel industry. They have also bought the mines, railways, and smelter of the Chillagoe company, which has spent millions on them in the last twenty years and never paid a dividend. They intend to spend $500,000 in opening the Einasleigh mine and putting the smelter in order. There is no chance of making a genuine profit. I have been there. They are also opening up a State arsenic mine to make a mixture to kill the prickly pear! Can you beat it!

At the Mount Elliott smelter in Queensland the furnace-men went on strike because they did not approve of the management lengthening the furnace to 28 ft. To please them, the length was reduced to 18 feet. Could this happen anywhere else?

The shipping strike, according to the Sydney 'Sun,' caused a loss in wages of £1,363,000. How long will it take the poor fools to make up this, even if they get an increase? If they are not being paid a living wage how can they afford to be idle from four to seven months?

Some years ago the Kanakas who worked on the sugar plantations in Queensland were deported, and the 'white Australia' policy was initiated. The cane-cutting is done by contract and the laborers refuse to work unless they can make £2 or £3 per day. Consequently less cane is being planted now than formerly and sugar has to be imported from Java and Fiji.

At Broken Hill, after four unsuccessful attempts in three weeks at the South mine and two by the Zinc Corporation, certain persons succeeded in burning down the headgear, 130 ft. high, the ore-bins, and part of the mill at the Broken Hill South, which was idle on account of the strike. This was the only mine at Broken Hill that employed any hands—chiefly on repairs and to relieve distress, and was the only one picketed by strikers. The damage is estimated at £90,000 ($400,000) and will take a year to replace. The Amalgamated Miners Association naturally deny that they had anything to do with it and insinuate that it was due to the carelessness of the management. The company offered a reward of £2000 for information leading to the arrest of the guilty parties.

About half the mileage of railways in New South Wales doesn't pay, but more roads are projected—with borrowed money, of course—to keep politicians in office. The same old game. They are even borrowing money now to *repair* roads.

At the Pelaw main colliery, in New South Wales, miners landed in trucks 2700 tons of coal in seven hours, earning over £2 per head.

In ten years Australia paid £625,000,000 for imports.

The miners at the Victorian State coal mine went on strike because the roads were muddy.

It is reported by the Commonwealth statistician that in six years up to 1918 there were 2153 disputes involving 7697 establishments. The workers numbered 9,156,589, and the loss of wages was £5,073,346. In 1918 there were 298 disputes.

The price of potatoes was fixed by Government at £18 per ton. And this is supposed to be an agricultural country! Wharf laborers at Wellington, N. Z., refused to load potatoes on an outgoing steamer. They said the export of potatoes was making the price high in New Zealand.

Australia's national debt is now £700,000,000 and its population about five millions. The debt per head is

£140. The Government tries to prevent capital from leaving the country; for example, the Austral-Malay company bought a tin mine in Bolivia, but the Government would not allow them to raise money in Australia to work it; consequently they registered a company in the United States at considerable expense, but have now removed the office to the Malay States.

It is well recognized that Australia is the working man's paradise and the educated man's purgatory. For instance, the Geelong Council advertised for an accountant at £156 per annum (10s. per day) and at the same time increased its laborers' daily wage to 10s. 8d. Many instances might be given of the same thing. In August last the Waterside Workers' Federation applied to the Arbitration Court for more pay and improved conditions. The secretary said he thought it was quite right for men who started work at 10 minutes to 9 to knock off at 9 o'clock for a smoke. He also asked for treble wages for Sunday work with a minimum of four hours engagement, which might mean in certain cases—such as handling explosives—a wage of £2 13s. for half an hour's work! In the case of the gas employees, members of the union claimed to be paid interest equal to the dividend paid to shareholders, such interest to be paid on the wages earned. Even Judge Higgins balked at granting this demand.

In testifying before the Railway Appeal Board in Queensland, after the Railway-men's Union had warned its members to prevent a trainload of police from reaching Townsville during the riots, more than one unionist swore that he would have risked his life had he disobeyed the union and it was better to disobey his employers, namely, the State.

WILLIAM MOTHERWELL.

San Francisho, October 3.

Braden

The Editor:

Sir—Really, Mr. Editor, such misinformation as is given in the article on 'Mining at Braden' in your issue of September 20 needs corrections. I refer particularly to the following statement made in the article by Mr. Cameron:

"It is quite a well-known fact, that certain engineers employed by the New York office reported unfavorably on doing any development work whatever on the Teniente mine, as they stated that surface indications and all other information such as can be gathered from a visit to the deposit proved to them conclusively that although there was a large deposit of mineralized rock, still it never would be mined as ore, as it assayed not over 0.5% copper."

It is not clear whom Mr. Cameron means by "certain engineers employed by the New York office," but as a matter of fact Mr. Pope Yeatman, the company's consulting engineer, recognized at once the great possibilities in the Teniente section of the mine when he first examined the property in 1910, and so reported, and he continued to believe in these possibilities. He was assisted on his first examination by Robert Marsh Jr., and on his second examination by Edwin S. Berry and Mr. Marsh, neither of whom were at that time "local officials of the mine," nor was Horace Graham until a considerably later date. The president of the company at that time, Barton Sewell, always had the greatest faith in the possibilities of the Teniente and was always anxious to have development work carried on in that section of the mine.

EDWIN S. BERRY.

New York, September 25.

The Handling and Smelting of Flue-Dust

The Editor:

Sir—I wish to submit for the consideration and criticism of your technical readers my proposed scheme for handling and smelting flue-dust. As far as I know, it is original, and, as I have not taken steps to patent it, the smelting companies may freely work out and apply the system to suit their local conditions.

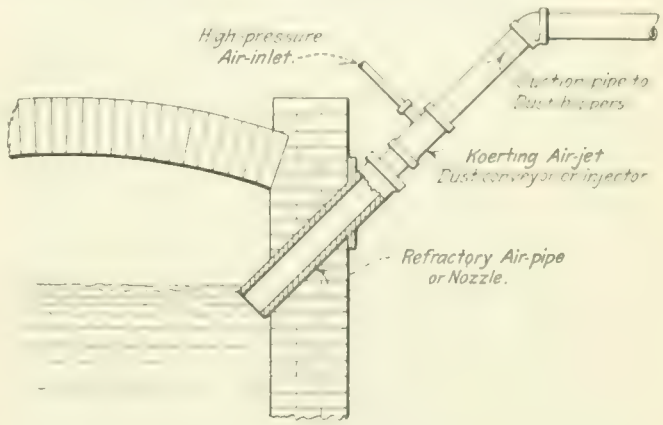


FIG. 1

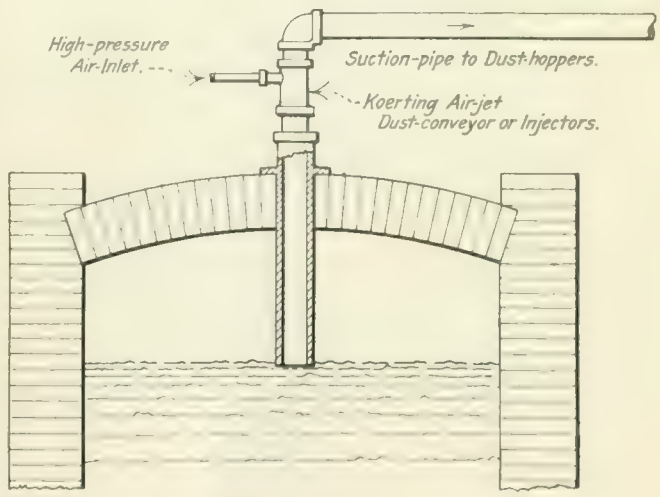


FIG. 2

I would make one or more openings in the side walls of reverberatory furnaces (say, eight or ten inches in diameter) and through the opening insert a movable pipe or nozzle of molded magnesite or other refractory material, pointing the nozzle downward at an angle into the molten bath in the furnace as shown above in Fig. 1.

I would connect to the end of this refractory pipe, outside the furnace, a Koerting air jet dust-conveyor or similar suitable injector of, say, 3 in. suction size, which would have capacity sufficient to drive 35 lb. of dust per minute into the molten bath. Suction-pipes to this injector would run from the bottom of the respective dust-hoppers so that the dust as deposited would be continuously 'sucked' from the hopper-bottoms and forced by the injector directly into the molten bath in the furnace without waste. At this point in the bath extra heat would be generated by the jet of high-pressure air. Consequently the inrushing dust would be immediately melted and incorporated in the bath, and not carried out of the furnace again as dust, as in present practice.

If preferred, the system could be applied by running the refractory pipe through the roof of the furnace so that the stream of dust and air would strike into the molten bath vertically as shown in Fig. 2.

I should like an opportunity for trying this system for some interested smelting company. It would cost very little to do so.

W. M. Barker.

McGill, Nevada, August 8.

How Tellurides Were First Found in Colorado

The Editor:

Sir—Away back in 1871 in the town of Boulder, Colorado, an old man, Lawrence Thompson, made a living by conducting a photograph gallery and assay-office combined. Neither gave a living alone but by combining the two he scraped through. I used to make his office a loafing place, often helping in the assay-office, and occasionally doing all the work when Thompson was busy elsewhere. I made my living in a printing-office. Men didn't know what a mining engineer was then. They thought he was a man who ran a hoisting-engine on a mine; and if they had known there would have been nothing to do for a boy but lately out of school.

One day, while the proprietor was absent and I was running the office, two German prospectors, Joe Steppler and Chris Halk by name, who had a claim called the Red Cloud, on Gold hill, ten miles distant, came into the office. Joe pulled out a chunk of ore weighing a pound and asked me to assay "this piece of gray copper." God Almighty in one of his manifold ways made telluride ore, but I doubt if he ever made a purer specimen than that was. As I remember it now, I'd be glad to give a hundred dollars, if I had it, for one like it. I was busy and didn't pay much attention; so I replied, "Buck it down, Joe." He had helped me doing such work before, and knew how. It is not surprising that he called it "gray copper," as that steel-gray mineral was the only thing anywhere near like it known to local prospectors. As for myself, I had never seen tellurium ore, and had only a hazy knowledge that there was a rare mineral named tellurium. Joe bucked it down and I sifted it and weighed out the tenth assay-ton generally used for a scorification assay, the kind made then. Joe went away and I finished the assay. I was astonished at the resulting button. It was yellow and as large as a goose-shot, with several little bright buttons scattered on the cupel to keep company with the big fellow. I weighed them all together. If it had been silver it would have been a tremendous assay. Joe came back and I gave him the results, whereupon he became 'mad as a wet hen.' He thought I was fooling him. To satisfy myself as much as him, I repeated the assay in duplicate, with results showing a close approximation to the first result. Then we held a council. I had never heard of ore so rich that did not show 'free', or visible, gold. Joe took my advice and carried some of the stuff to Prof. Schirmer, assayer in charge at the branch mint or Government assay-office at Denver. He named it the telluride of fiold. John Ruthman, a German druggist in Denver, bought the Red Cloud for $25,000, and the news spread like wildfire. A boom began, but it took three years to get under full headway. This is the whole story of the discovery of tellurium and the first mining boom after the birth of the Territory of Colorado. It was not a great one, but it was interesting. The cream of the ore was mostly on the surface. A system of trenching was started along the outcrops of the veins, and I think most of them showed good ore somewhere on the surface. In sinking their 10-ft. discovery-shafts the American claim yielded $17,000; the Grand View, Cold Spring, John Jay, and Melvina each gave $10,000 or more out of their discovery-shafts. The true story of the discovery of the Melvina reads like a yarn. It is as follows:

A couple of 'tenderfeet', who could not tell quartz from granite, stopped at a mine cook-tent and asked to be shown a good place to discover a mine. Someone said to them, pointing to a pine-tree a little way off, "under that tree is a good place." They had a pick and shovel, so, taking off their coats they began to dig under the tree. The trail from the Hoosier mine ran close by the tree. I have often tramped it and know there was no more sign of an outcrop there than in a grassy meadow. When the tenderfeet had dug a shallow hole, not two feet deep, Henry Neikirk, a well-know miner, came walking along the path and stopped to see what they had found and talked with them. The day was warm and the tenderfeet complained about the unaccustomed work and heat. They did not know they had found anything, but Neikirk did. He offered to finish their shaft for what ore he took out, if he found any; and a half-interest in the claim. The proposition was accepted. The hole yielded over $10,000, and in a year Neikirk was the director of a bank and walked on easy street. The American mine sold 40 tons that averaged over $5000 per ton. Some of these mines are still being worked, but their glory has departed.

W. C. Wynkoop.

San Francisco, October 10.

The U. S. Geological Survey now has available for distribution its annual statement on cadmium in 1918. The production in 1918 fell off considerably in both quantity and value.

A New Goldfield in Ontario

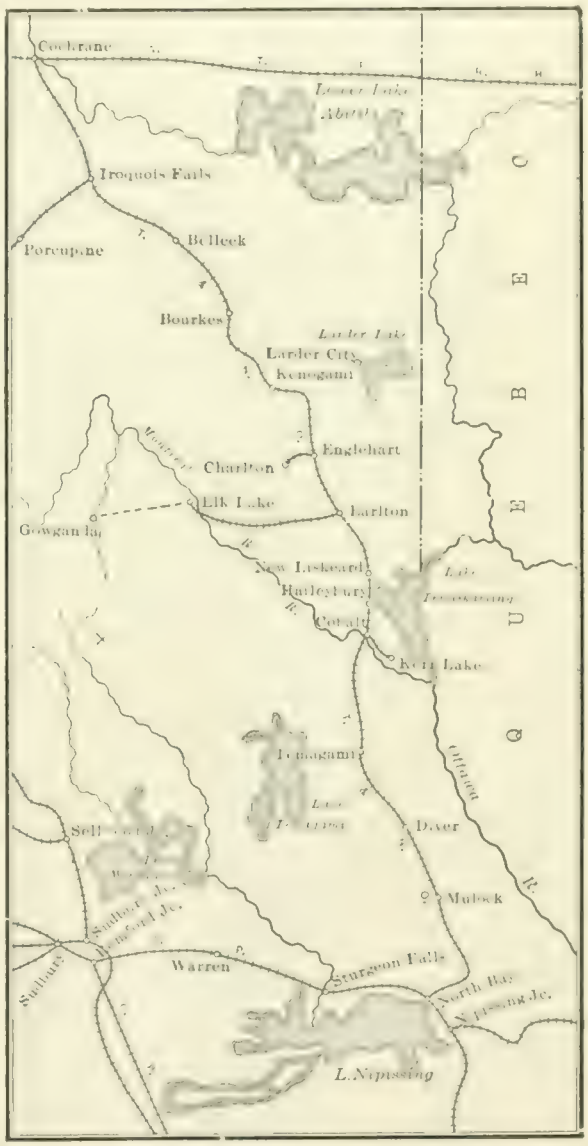
By REGINALD E. HORE

Gold mining in Canada has received an impetus in recent years from the successful development of such mines as the Hollinger, Dome, McIntyre, and Lake Shore mines in Northern Ontario. Although these mines have been operating under adverse conditions their successful operation has demonstrated tremendous possibilities for the undeveloped parts of Quebec, Ontario, and Manitoba, where there are many areas that may be expected to enclose gold deposits. Development is at present chiefly in the district served by the Ontario Government railway, which is itself largely responsible for the discovery of the Porcupine gold veins, as well as the Cobalt silver lodes. In less accessible regions in other parts of Ontario and in Quebec and Manitoba development is slower. In 1918 the mines of Ontario produced $8,502,542 in gold, and they will produce much more when operating at full capacity. Labor unrest and high prices are disturbing the mining industry as they are other industries, but those who wish to produce gold in normal times must proceed with development now.

During the War there was naturally little progress in developing new areas. In some cases, however, the work has been notably successful and important new sources of gold have been clearly indicated. One such area is that now known as the Wasapika gold area, which includes parts of the townships of Churchill and MacMurchy in the Sudbury Mining Division, Ontario. I have recently visited this area, and I am convinced that it is a promising one. Its position is indicated by a cross on the accompanying map.

The three properties that are in the most advanced stage of development are the Wasapika, West Tree, and Herrick. The work that has been done on these properties should prove encouraging to the operators. The Wasapika is situated near the south end of Michikawakenda lake; the Herrick is on the west shore of the lake, and the West Tree adjoins the Wasapika on the east, extending northward across Upper Wasapika lake. Gold has also been found on several properties near these three.

At the Wasapika a vein, known as the Ribble, has been stripped and sampled at surface and has been cut at a depth of 100 ft. At the surface there was evidence that the deposit was large and the sampling showed that it is of good grade. At the 100-ft. level the deposit is even larger than it appears to be at the surface. The vein strikes north and is partly exposed on the west face of several outcrops. The eastern edge is well exposed in several places, but the westerly portion cannot be seen so well as the exposures are at the edge of low wet ground that does not permit complete stripping. The operators have located the first shaft about 80 ft. west of the surface exposure of the vein, have sunk to a depth of 100 ft., and then driven a cross-cut east toward the vein. The cross-cut passed through several small quartz veins in the first 30 ft. and at 31 ft. entered a thick vein of quartz, which has not yet been penetrated. This quartz is well mineralized with numerous small crystals of pyrite and occasional grains of chalcopyrite. Until



MAP OF PART OF ONTARIO

the cross-cut is completed and the deposit opened up by drifts north and south the actual gold content will not be determinable, but it is probable that there is now being developed an orebody that will produce a large quantity of gold. The surface sampling gave good results. The development so far has been satisfactory. The operators have reason to believe that they have the

[illegible] of a big gold mine. My own opinion is that [illegible] in the property is well justified.

At the West Tree property a red deposit is being developed. A shaft is being sunk in this deposit near the [illegible] Upper Wasapika lake. In the shaft, the narrow [illegible] veins are being broken as the work progresses. Across the lake and a few hundred feet from this shaft is another shaft from which some rich ore was taken a few years ago. It is the intention of the West Tree company to drive across the lake toward this second shaft. In this way the deposit that strikes across the lake will be developed, and at the same time it is probable that another vein which is exposed near the south end of the lake and which strikes up the lake will be [illegible].

At the Herrick a well-defined vertical gold-quartz vein has been stripped and sampled and a shaft has been sunk on the vein to a depth of 50 ft. The surface showed good ore; likewise the vein in the shaft. The operators decided to test the deposit by numerous diamond-drill holes. The first hole has been started at a dip angle of 60° at a point 230 ft. west of the shaft. If the vein continues vertical it should be encountered at a depth of about 450 feet.

The good results being obtained at the Wasapika, West Tree, and Herrick will result in the development of many other properties in the vicinity. On the Atlas property camps have been constructed and some development work is being done. The Saville-McVittie, south-east of the West Tree, is still idle. The Churchill property, south of the Herrick, is receiving some attention and prospecting has been begun on the Wakenda properties, north of the Herrick. All these and several other properties in the neighborhood merit attention.

Alamosa creek valley, which is about 50 miles northwest of Magdalena, in northern Socorro county, New Mexico, includes several areas in which it is worth while to drill for oil and gas, according to a report just submitted by Dean E. Winchester for publication by the U. S. Geological Survey. Mr. Winchester describes anticlines in which the sandstones of the Miguel formation (Mancos shale) and the Dakota sandstone can be penetrated at depths not exceeding 2500 ft., considers the possibility of finding oil and gas in the region, and after making a study of the physical and chemical characteristics of the rocks, including the carbonaceous beds, concludes that the chances of getting oil are good and that if oil is found it will be of high grade and will probably be accompanied by gas. The rock beds in the region have been folded into well-defined anticlines and synclines, and in some places have been faulted, but the oil, if it ever existed in the formations, has probably not escaped. One of the most favorable places for testing the region for oil and gas is along the Cow Springs anticline, in Sec. 19 or 30, T. 4 N., R. 9 W., where fuel for the boilers of the drilling machines can be mined within sight of the rig. The chances of getting oil or gas in the formations below the Dakota sandstone are not considered good, but these sands can be tested by a well drilled to a depth of 3000 ft. in Sec. 2, T. 3 N., R. 8 W., on the west side of the Red Lake anticline and fault.

Tungsten in Peru

Practically all the tungsten ore exported from Peru is produced in the districts of Conchucos and Corongo, both situated back of the ports of Salaverry and Chimbote, the mineral being transported over the mountains on the backs of llamas and burros from the tungsten mines to the railways connecting with these two ports. Practically all mining of tungsten is done in a very primitive manner. The miners are the Indians—what are commonly known in Peru as cholos—of the mountain districts. The mineral is all hand washed by the Indians. The mining of tungsten in Peru may be considered sporadic; that is, its development depends largely upon the demand and prevailing prices in Liverpool and New York. When the price of the ore is low, little interest is manifested in it, and the Indians are withdrawn from the tungsten mines or holes to be occupied in the copper and silver producing mines in the same district. Fortunately during the last four years there has been a good demand for tungsten, which has favorably affected the industry.

Prior to the war about 60% of all tungsten exported from Peru went to Germany. Since the middle of 1914 the exports have been diverted to the United States, a small quantity finding its way to Great Britain and France. During 1918, 246,562 kilos was exported from Peruvian ports to New York. The tungsten content was 151,313 kilos, and the value $335,799.

It is difficult to ascertain the cost of the production of tungsten delivered at the coast, as it depends upon the distance the ore is transported by llamas and burros, the proximity of the mines to the railways, and the wages paid. The cost of mining and delivering the concentrates at the seacoast is probably small in comparison with the prices received during the War for the ore, particularly when it is known that the average Indian miner works for about $1 per day. The price received for the ore is regulated by the prevailing price of the mineral markets of Liverpool and New York. Tungsten is shipped in concentrates of from 58 to 60%. The owners of the ore generally arrange with the buyers to draw against each shipment up to 70% of its value. The price of tungsten in June 1919 was about $10 per unit of 60% concentrate. Before the War it was about $7; during the War the price reached the maximum of $26 per unit.

The crude barytes produced and marketed in the United States in 1918 amounted to 155,241 short tons, one-fourth less than the quantity marketed in 1917, and one-third less than that marketed in 1916, according to statistics collected by the U. S. Geological Survey. The average price per ton was $6.73, as against $5.66 in 1917 and $4.56 in 1916.

Mining on the Indian Reservations

Section 26 of the Act of June 30 [Public No. 3 66th Congress] specifies as follows:

That the Secretary of the Interior be and hereby is authorized and empowered, under general regulations to be fixed by him and under such terms and conditions as he may prescribe, not inconsistent with the terms of this section, to lease to citizens of the United States or to any association of such persons or to any corporation organized under the laws of the United States or of any State or Territory thereof, any part of the unallotted lands within any Indian reservation within the States of Arizona, California, Idaho, Montana, Nevada, New Mexico, Oregon, Washington, or Wyoming, heretofore withdrawn from entry under the mining laws for the purpose of mining for deposits of gold, silver, copper, and other valuable metalliferous minerals, which leases shall be irrevocable, except as herein provided, but which may be declared null and void upon breach of any of their terms.

That after the passage and approval of this section, unallotted lands, or such portion thereof as the Secretary of the Interior shall determine, within Indian reservations heretofore withheld from disposition under the mining laws may be declared by the Secretary of the Interior to be subject to exploration for the discovery of deposits of gold, silver, copper, and other valuable metalliferous minerals by citizens of the United States, and after such declaration mining claims may be located by such citizens in the same manner as mining claims are located under the mining laws of the United States: *Provided*, That the locators of all such mining claims, or their heirs, successors, or assigns, shall have a preference right to apply to the Secretary of the Interior for a lease, under the terms and conditions of this section, within one year after the date of the location of any mining claim, and any such locator who shall fail to apply for a lease within one year from the date of location shall forfeit all rights to such mining claim: *Provided further*, That duplicate copies of the location notice shall be filed within sixty days with the superintendent in charge of the reservation on which the mining claim is located, and that application for a lease under this section may be filed with such superintendent for transmission through official channels to the Secretary of the Interior: *And provided further*, That lands containing springs, water holes, or other bodies of water needed or used by the Indians for watering live stock, irrigation, or water-power purposes shall not be designated by the Secretary of the Interior as subject to entry under this section.

That leases under this section shall be for a period of twenty years, with the preferential right in the lessee to renew the same for successive periods of ten years upon such reasonable terms and conditions as may be prescribed by the Secretary of the Interior, unless otherwise provided by law at the time of the expiration of such periods: *Provided*, That the lessee, may in the discretion of the Secretary of the Interior, be permitted at any time to make written relinquishment of all rights under such a lease and upon acceptance thereof be thereby relieved of all future obligations under such lease.

That in addition to areas of mineral land to be included in leases under this section the Secretary of the Interior, in his discretion, may grant to the lessee the right to use, during the life of the lease, subject to the payment of an annual rental of not less than $1 per acre, a tract of unoccupied land, not exceeding forty acres in area, for camp sites, milling, smelting, and refining works, and for other purposes connected with and necessary to the proper development and use of the deposits covered by the lease.

That the Secretary of the Interior, in his discretion, in making any lease under this section, may reserve to the United States the right to lease for a term not exceeding that of the mineral lease, the surface of the lands embraced within such lease under existing law or laws hereafter enacted, in so far as said surface is not necessary for use of the lessee in extracting and removing the deposits therein: *Provided*, That the said Secretary, during the life of the lease, is hereby authorized to issue such permits for easements herein provided to be reserved.

That any successor in interest or assignee of any lease granted under this section, whether by voluntary transfer, judicial sale, foreclosure sale, or otherwise, shall be subject to all the conditions of the lease under which such grants are held and also subject to all the provisions and conditions of this section to the same extent as though such successor or assign were the original lessee hereunder.

That any lease granted under this section may be forfeited and cancelled by appropriate proceedings in the United States district court for the district in which said property or some part thereof is situated whenever the lessee, after reasonable notice in writing, as prescribed in the lease, shall fail to comply with the terms of this section or with such conditions not inconsistent herewith as may be specifically recited in the lease.

That for the privilege of mining or extracting the mineral deposits in the ground covered by the lease the lessee shall pay to the United States, for the benefit of the Indians, a royalty which shall not be less than 5 per centum of the net value of the output of the minerals at the mine, due and payable at the end of each month succeeding that of the extraction of the minerals from the mine, and an annual rental, payable at the date of such lease and annually thereafter on the area covered by such lease, at the rate of not less than 25 cents per acre for the first calendar year thereafter; not less than 50 cents per acre for the second, third, fourth, and fifth years, respectively; and not less than $1 per acre for each and every year thereafter during the continuance

of the lease, except that such rental for any year shall be credited against the royalties as they accrue for that year.

That in addition to the payment of the royalties and rentals as herein provided the lessee shall expend annually not less than $100 in development work for each mining claim located or leased in the same manner as an annual expenditure for labor or improvements is required to be made under the mining laws of the United States: *Provided*, That the lessee shall also agree to pay all damages occasioned by reason of his mining operations to the land or allottment of any Indian or to the crops or improvements thereon: *And provided further*, That no timber shall be cut upon the reservation by the lessee except for mining purposes and then only after first obtaining a permit from the superintendent of the reservation and upon payment of the fair value thereof.

That the Secretary of the Interior is hereby authorized to examine the books and accounts of lessees, and to acquire them to submit statements, representations, or reports, including information as to cost of mining, all of which statements, representations, or reports so required shall be upon oath, unless otherwise specified, and in such form and upon such blanks as the Secretary of the Interior may require; and any person making any false statement, representation, or report under oath shall be subject to punishment as for perjury.

That all moneys received from royalties and rentals under the provisions of this section shall be deposited in the Treasury of the United States to the credit of the Indians belonging and having tribal rights on the reservation where the leased land is located, which moneys shall be at all times subject to appropriation by Congress for their benefit, unless otherwise provided by treaty or agreement ratified by Congress: *Provided*, That such moneys shall be subject to the laws authorizing the pro rata distribution of Indian tribal funds.

That the Secretary of the Interior is hereby authorized to perform any and all acts and to make such rules and regulations not inconsistent with this section as may be necessary and proper for the protection of the interests of the Indians and for the purpose of carrying the provisions of this section into full force and effect: *Provided*, That nothing in this section shall be construed or held to affect the right of the States or other local authority to exercise any rights which they may have to levy and collect taxes upon improvements, output of mines, or other rights, property, or assets of any lessee.

That mining locations, under the terms of this section, may be made on unallotted lands within Indian reservations by Indians who have heretofore or may hereafter be declared by the Secretary of the Interior to be competent to manage their own affairs; and the said Secretary is hereby authorized and empowered to lease such lands to said Indians in accordance with the provisions of this section: *Provided*, That the Secretary of the Interior be, and he is hereby, authorized to permit other Indians to make locations and obtain leases under the provisions of this section, under such rules and regulations as he may prescribe in regard to the working, developing, disposition, and selling of the products, and the disposition of the proceeds thereof of any such mine by such Indians.

Production of Quicksilver

The output of quicksilver in the United States from April 1 to June 30, 1919, according to figures compiled by F. L. Ransome, of the U. S. Geological Survey, was 3940 flasks of 75 lb. net, a decrease of 2020 flasks, or of nearly 34%, as compared with the output in the first quarter. Only 16 mines were producing in the second quarter of the year as against 23 in the first quarter. Of the 3940 flasks produced, 2632 flasks is credited to California, 1244 to Texas, 34 to Nevada, and 30 to Oregon. The quicksilver on hand at the mines or in transit to market at the end of the second quarter amounted to 1635 flasks, which was 2784 flasks less than the quantity on hand or in transit at the end of the first quarter.

The average monthly prices of quicksilver in San Francisco during the second quarter of 1919, as quoted in the 'Mining and Scientific Press,' were: April, $73.12; May, $84.80; and June, $94.40. The price thus made a progressive increase from $72.80 in March, which was the lowest price since the beginning of the war. The downward trend of the price of quicksilver during the first quarter, the uncertainty as to the future, and the high cost of operation, together with the general scarcity of readily available ore, co-operated to diminish production at the beginning of the second quarter, and the mines have not yet responded at equal rate to the activity in the quicksilver market at the end of that quarter. A number of mines ceased operation early in the quarter, and it is not to be expected that these should immediately resume production at every appearance of improvement in the conditions that affect the mining of quicksilver.

With the cessation of hostilities between the principal belligerents in the great war some of the quicksilver producers were decidedly pessimistic as regards the future of the industry. They expected an immediate influx of foreign quicksilver and a fall in prices approximately to the level of those that prevailed early in 1914. The present conditions, however, appear to indicate that at least some of the producers were unduly apprehensive of immediate disaster.

THE PRICES OF CRUDE OIL have remained practically constant since the entrance of the United States into the world war, but the future is generally considered so promising commercially by the industry that every effort has been made toward finding new fields and bringing old fields to a high stage of development. Prospecting for oil is conducted almost entirely by the large companies upon geological advice. At the present time the chief centre of interest is the Paleozoic belt in Texas and the Cretaceous formations in Wyoming.

Technical Operations on the Suan Concession, Korea—II

By A. R. WEIGALL and J. F. MITCHELL-ROBERTS

PROSPECTING. With the successful development of the Suan mine, and a better realization of the general geologic conditions on the Concession, the possibility of other geologically similar orebodies around the edges of the granite intrusion arose, and prospecting operations on a small scale were started. At the commencement no definite plan was formulated and a foreigner with extensive local experience took charge of this work. A bonus was also offered to any Korean who discovered a profitable orebody, and a small sum of money was expended in paying independent native prospectors for work done.

In former times the Koreans had done a great deal of prospecting and shallow mining all over the country, and every large metal mine operated today in Korea is on the site of extensive ancient workings. Also in every case the Koreans were operating the mine with their primitive methods of mining and milling at the time the property was taken over by Japanese or foreign mining companies. The Tul Mi Chung mine on the Concession is probably the only exception in Korea of a profitable mine being developed at a place where Koreans were not actively engaged in working the ore at the time when a foreign company commenced mining operations, and even in the case of Tul Mi Chung there is evidence of extensive old workings, obviously of great age, as the signs of work had been almost obliterated and the site covered with vegetation. As compared with other old workings in Korea, comparatively little had been done at Tul Mi Chung by the natives, probably on account of the refractory nature of the ore and the difficulty of extracting the gold, and further because the copper content of the ore was too small to pay for its recovery by primitive methods. On the other hand, when modern operations were commenced at the Suan mine a great deal of Korean shallow mining had been done and was actively in progress. At the time the property was first examined, practically all ore in sight had been mined leaving only the shell of the deposit, a fact that made it difficult to form any reliable opinion as to the deeper extension of the orebodies and their average grade. As a general rule, the Koreans had followed the ore until their workings caved or until they reached water-level.

Although throughout Korea the native miners had mainly confined their work to the softer and richer bands of ore, which could be won without the aid of explosives, still the existence of old workings has been of the greatest possible assistance to prospecting operations and has led to the discovery of practically every mine worked today in Korea.

The Korean methods of mining and extracting gold and other metals, principally iron and copper, are of the primitive type usual in Oriental and tropical countries. The mine-workings consist of small and irregular openings through which it is difficult to crawl. The ore was broken by moils and hammers, and carried to the surface in small sacks or baskets. Where the ore was hard it was cracked by fire-setting. On arrival at the surface, the ore was broken to small size and carefully hand-sorted, a process at which the Koreans exhibit remarkable skill. The sorted ore was then ground under rocking-stones operated by hand, or, in later times, in small iron-shod wooden stamp-mills driven by water-wheels. The finely ground ore was then panned for its gold content. The use of cylindrical revolving stones was adopted in order to accomplish additional grinding and to free the fine gold from the sulphide minerals, and allow it to be recovered by panning.

The first prospecting work done on the Concession was mainly directed to the search for old workings, which when found were cleaned out and opened up according to the evidence obtained. In this manner the discovery of the Tul Mi Chung mine was made.

It was soon seen that haphazard methods of prospecting were inadequate. It was early recognized that the surficial impoverishment, which was such a marked feature of the orebodies then known, might easily cause a large orebody to be overlooked; moreover, the old Korean miners had searched for the small high grade deposits, so that a large low-grade orebody, which might not have been of value to the natives, might easily prove profitable when exploited by modern methods.

As a first step a reliable geological and topographical map of the whole Contact was made by D. F. Higgins, and this map and the lengthy report that accompanied it allowed the prospecting work to be planned in a systematic manner. In this report Mr. Higgins laid down the following criteria for the guidance of further prospecting on the Concession:

"1. Leached, oxidized, rusty-looking, and copper-stained outcrops. This criterion is, of course, a general one for all districts.

2. Placers at or below the Contact.

3. Old Korean workings.

4. Contact-minerals; such as tourmaline, diopside, and garnet.

5. Evidence on the surface of faulted or sheared zones in the rock just outside the Contact.

6. Limestone contacts are more likely places than schist contacts with the granite.

7. Especial activity of magmatic waters, as shown by the degree of intensity with which the metamorphic minerals are localized.

8. Evidences of differentiation in the magma as shown

by the presence at the contact against the granite of small bodies of igneous rock related to the granite.

These criteria are only intended to apply to deposits along the Contact. Especial attention is called to the importance of the fifth and eighth ones. The last is the feature that separates Hoikol Sinan and Tul Mi Chung from all the other present openings. Very careful search should be made along the Contact for contact ore-shoots similar to the Hoikol granite and the Tul Mi Chung quartz-porphyry, and the Tul Mi Chung tourmaline-granite, and, if found, their vicinity should be very carefully examined for evidences of mineralization."

Shortly following the completion of this geological report an experienced mining engineer was engaged to take charge of the prospecting and provided with a staff of foreign assistants. The work was first based on the general geologic information available, the main feature of which is the central boss, or batholith, of granite whose circumference, or contact with the surrounding sedimentary rocks, is the locus of most of the ore on the Concession. The granite intrusion, while not greatly altering the general dip of these sedimentaries, has faulted them considerably so that although the general dip and strike is more or less the same all round the boss, the fault-lines radiate and cross in all directions. These faults have served as the channels by which ore has been led to its present situation. A number of intrusive basic dikes occur but have no relation to the distribution of the ore; they consist of various types of basalt, dolerite, etc. The aplite acid dikes, on the other hand, appear to have been extruded at about the period of ore deposition and are consequently frequently associated with the occurrence of ore and almost universally contain a trace of gold in themselves, even thousands of feet away from the main contact.

From experience it has been found that for ore deposition here the following main features are essential, namely, (1) a suitable material for replacement, (2) an impervious hanging wall, such as schist, granite, or intrusive dike, and (3) faulting connected with the main granitic intrusion for the passage of the hot mineralizing solutions that have been the source of the ore.

The centre of the Concession is the granite boss, which rises to a height of 4000 ft. above the sea-level. From the granite the streams radiate like the spokes of a wheel. The boss is approximately 23 miles in circumference and where it meets the limestone is mostly about 1000 ft. above sea-level, whereas the junction of the granite and the schist ridges runs up to 3000 ft. above sea-level. The streams leading away from the centre of the granite area and crossing the Contact have acted as sluices, and, in this way, have in places formed small gold-placer deposits, most of which have been worked by Koreans. Such placers have been an important guide in prospecting, as indicating the occurrence of ore in the watershed drained by any given stream.

In preparing the prospecting program the whole area around the Contact was mapped into blocks of approximately a mile square, such maps being enlargements of the geologic map of the Contact, and drawn to a scale of 150 ft. to the inch. On these enlarged plans all the known data were plotted and all additional information obtained was added monthly. Each block then received a preliminary prospecting by a foreign prospector with Korean panners. Holes were sunk to bedrock about 300 ft. apart up all creeks and valleys and a full record plotted on the block-maps showing depth of hole, nature of bottom, and whether panning yielded any gold or other ore-mineral, garnet-sand, etc. If any such minerals were found, intermediate holes were then put down 100 ft. apart. When any mineral had been found or any promising indication of ore, a close inspection of the surface and a study of the geology of the block under examination was made; a larger area was marked out of such extent that it could be covered by a man in a day, and this area placed under the charge of a foreign prospector and his Korean assistants. This area was then subjected to an intensive prospecting and panning campaign, the original prospectors being moved to the next block, and so on.

The second stage comprised not only the panning of the creeks and valleys, but also the panning of the hillsides as well, until the minerals discovered had been traced to their source. This was done by placing holes about 100 ft. apart, and if the top one showed no gold or ore mineral, then holes were sunk half-way to the last one that showed gold, and so on until the approximate line of mineralization had been ascertained. A series of trenches was then sunk across the line of mineralization and if indications of sufficient promise were obtained, underground work was started.

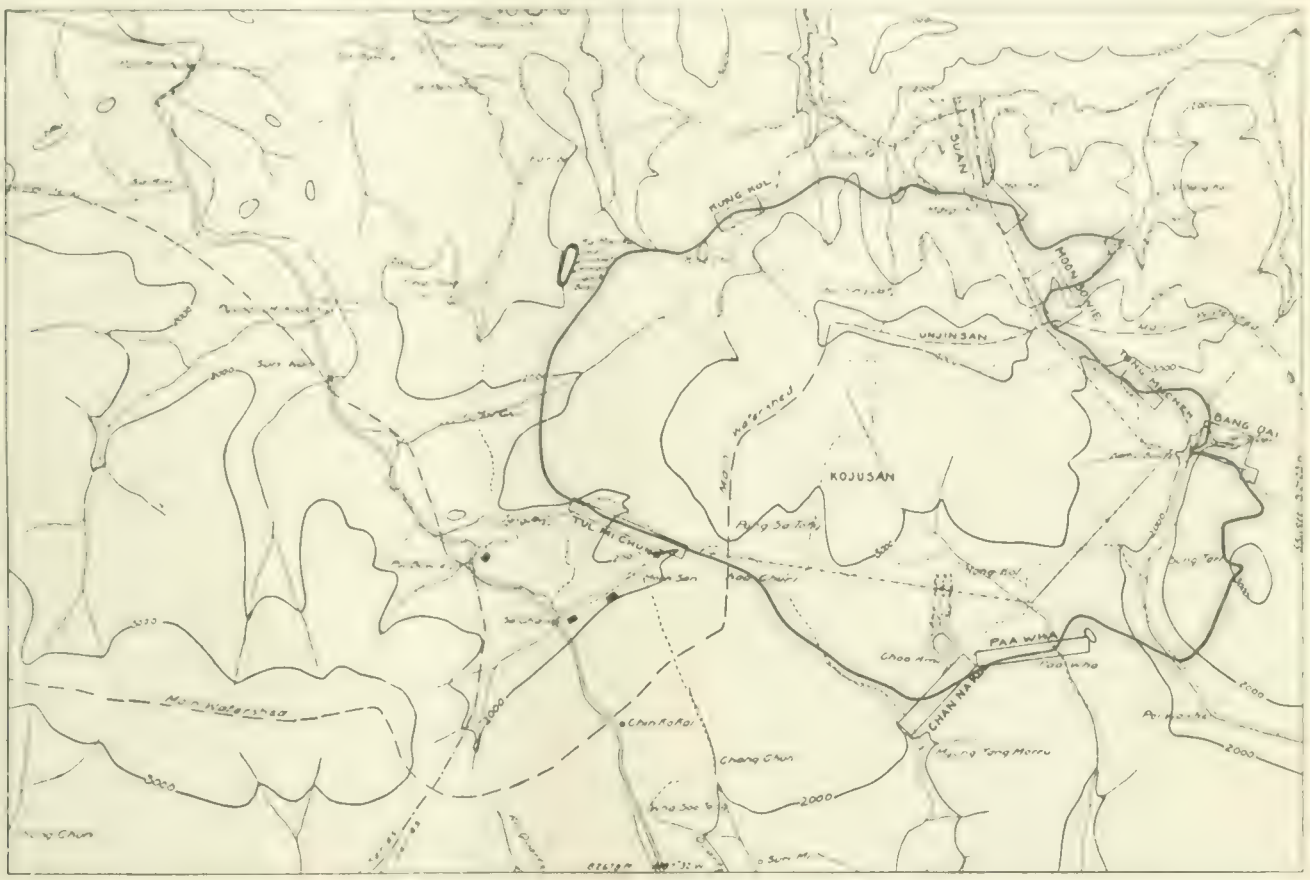
All holes sunk were panned in two-foot deep sections and the last half-ounce in the pan was in each case retained and put into one 'creek' sample. Composite 'creek' samples were made up into 'district' samples, and a complete analysis made of them to ascertain the minerals present. Such analyses were supplemented from time to time by special analyses made abroad by firms who specialize in the analysis of rare minerals. Microscopic examinations were also constantly made at the mine. By this means it was soon found out that, for instance, tungsten in small amounts was widely distributed around the Contact.

The underground prospecting work consisted of carefully following the irregular mineralization in all of its twists and turns, because, owing to the erratic occurrence of the orebodies, anything like straight and regular drifts or winzes was out of the question. In all such work especial attention was paid to the faults recorded on the plans. The district prospectors were afforded every opportunity of going over the stopes and development work in the producing mines in order to familiarize themselves with the nature of the ore-occurrences and as a rule were employed for a time in the mining operations before being engaged in prospecting work.

The average area covered by one foreigner in an intensive panning campaign was about four square miles and it usually took him about six months to prospect such an area at a total cost of about $2000. The average cost of prospect-panning holes has worked out at about

five cents per foot sunk. The cost of trenching has varied greatly, but has averaged about seven cents per cubic yard excavated.

This prospecting campaign has resulted in the discovery of profitable ore at several localities around the Contact, to say nothing of the dozens of previously unknown outcrops that finally proved valueless but would nevertheless have formerly been missed under the old methods of prospecting. A similar plan of prospecting would, no doubt, be found suitable for the investigation of mineral possibilities in other regions, particularly in the case of deposits of this type where the outcrops are not prominent.



MAP OF THE CONCESSION, SHOWING HOW THE WHOLE CONTACT (MARKED BY THE SHADED LINE) WAS INCLUDED

After D. F. Hewett

Estimation of Ore. The determination of the average grade of the ore in deposits of this type presents more than the usual difficulty. Not only are the orebodies exceedingly irregular both in size and shape, but also the ore itself shows great variation in its metal contents. Spotty assays are more the rule than the exception. Another feature that adds to the difficulty, as compared with the estimation of ore-reserves in ore deposits of a more regular type, is that the rectangular blocking out of ore by drifts and winzes is not practicable. The orebodies contain unsuspected 'horses' and sheets of barren limestone, which call for caution in allowing for the extension of ore; and attempts to allow for this are often made only to find that an orebody has, suddenly and without any apparent reason, increased to twice its expected size, or the reverse. The difficulty is to avoid excessive under-estimation on the one hand and too optimistic over-estimation on the other, as, of course, is the case in all estimates; but in this particular instance the difficulty of making the correct allowances and deductions is unusually great, and it requires considerable local experience and a good knowledge of the general geologic conditions in order to arrive at a correct appraisal of the ore-reserves developed at any time.

All sampling, surveying, and ore estimation on the Concession is carried out by one department, called the Ore Estimation and Surveying Department. The mine-plans are divided up into blocks of 100 ft. square, numbered from east to west and marked alphabetically from north to south. All workings are referred to a block number and a letter, for instance, "Block 20 R. Winze on No. 1 Level", and all mining or assay plans show this block system. The general mine-plans are on a scale of 50 ft. to the inch. Mine models are also used for the chief workings.

The underground workings in the mines and prospects are sampled at five-foot intervals, whether they are in ore or not, the results being recorded on assay-plans drawn on a scale of 20 ft. to the inch. These assay-plans are on sheets of standard size, each 40 by 25 inches, for convenience in handling. Cross-cuts and winzes in ore, as shown by the preliminary sampling-records of the assay-plans, are re-sampled on both sides of the workings.

Stopes are sampled twice every month. When the boundary of any stope is reached in mining, a series of long holes is put into the walls and the drillings assayed to make certain that the true limits of the orebodies have been reached.

The prospects on the Concession are sampled as the workings progress by the foreign prospector, and all workings in ore are re-sampled by the Ore Estimation Department. Mining and assay plans and the mine models are brought up to date monthly. Besides the actual assays, the main geologic features and faults are recorded.

The average deductions made from the actual assay-averages vary with the different blocks of ore, but as a rule 15% of the gold content and 10% of the copper content as shown by assay are deducted to arrive at the true average grade of the ore. In certain stopes, where the gold content is relatively low and the copper content high, 10% of the gold value and from 15 to 25% of the copper value, as shown by the assay-records, is deducted to arrive at the estimated grade of the ore in a block. No fixed rule is adopted and the question of the percentage deducted in every case from the assay-averages is largely governed by the degree of 'spottiness' or irregularity of the assays for the orebody in question.

Very high, or 'freak,' assays, especially in the case of rich ore surrounded by poor ore, are disregarded in computing averages. Rich spots are re-sampled, and if the re-sampling checks the original high assay, an average of the surrounding assays is made and this average result substituted for the eccentric result. Here again the number of surrounding assays that are included to arrive at the average figure to be substituted depends on the irregularity of the surrounding results.

Grab-samples from each car of ore sent to the mill are taken at the chutes and the actual average grade as ascertained by milling furnishes a pro-rata correction for that month, serving as a rough check for the grade of the ore mined from each block during the month. A sheet is prepared monthly showing the value of each block stoped during that period according to the grade specified in the re-estimate. The total metal in the ore as called for by this estimate is then compared with the actual metal in the ore as furnished by the mill-results and a correcting factor obtained, from which any adjustment of grade in the ore-reserve estimates is made. This practice, if carried out over long periods, allows of close approximation being obtained. During the past year the actual grade of the ore milled has shown a remarkably close agreement with the estimated grade of the ore mined.

A monthly report, together with full plans, is prepared by the Department. This shows the total tonnage of the ore reserve as brought up to date and into adjustment with the latest information covering tonnage, and its average grade as given by the last stope-plans and the milling results. In this manner the actual tonnage available not only on the whole concession, but also in each block of ore in the various mines and prospects, forms part of the monthly mining reports and allows the whole underground situation at any time to be seen at a glance. The system employed is doubtless more elaborate than the general practice, but is made necessary on this concession by the unusual irregularity of the ore-occurrences. It required some time and care to standardize the results in calculating the ore-estimates, but we have now arrived at a stage where complete reliance is placed on the monthly reports of the ore-reserve.

The Ore Estimation and Surveying Department consists of two foreigners, one Korean assistant-surveyor, three Korean draftsmen, one Korean survey-assistant, and one coolie, as well as two sampling-crews each consisting of three Koreans. The average total monthly cost of the department amounted in 1918 to $755.

Mining. The first work done on the Concession was done at what is now the Suan mine. The mine had already been worked to varying depths, averaging 50 to 75 ft. below the outcrop, by Koreans; but most of these old workings had caved and were inaccessible. Practically no ore was in sight.

The first underground work consisted of driving three cross-cuts with the object of cutting the continuation of the ore below the old Korean workings. This work did not succeed in its object because the old workings extended to greater depth than was supposed. Also, as it happened, where these cross-cuts did cut the ore-channel it proved to be small in size and low in grade. Accordingly, it was decided to sink from the cross-cut level and cut the formation at greater depth. A vertical winze was sunk to a depth of 120 ft. and at this level a considerable amount of driving and cross-cutting was done. Owing to an error in deciding what was the true dip of the deposit, and also on account of the bulk of this development work being done on what afterward proved to be a small and comparatively worthless stringer outside the main orebody, it was decided, after about two years of somewhat disappointing work, that the deposit did not present sufficient promise to warrant further expenditure, and the mine was shut-down.

At this time the property was jointly owned by the Korean Syndicate, a British firm, and Collbran & Bostwick, an American firm carrying on business in Korea, and the whole of the mining work done was performed under the direction of the engineers of the first-named corporation. When the decision to shut-down the mine was reached by the Korean Syndicate, Messrs. Collbran and Bostwick were in favor of more exploratory work before the property was abandoned, and an arrangement was made by which the American firm took over the property and recommenced work, the British firm accepting in return for its half-interest a share of any profit that might be won and relief from any further expenditure. Directly following this arrangement, Messrs. Collbran and Bostwick secured pumping machinery, and, after unwatering the workings, continued the development of the mine. The first work done was to drive cross-cuts from the bottom of the former workings. Almost immediately the pluck and persistence shown by this

firm was rewarded by the discovery of a large body of high-grade ore. Following this promising discovery, the Seoul Mining Company was formed on April 27, 1908, to take over the rights owned by Collbran and Bostwick, and by the sale of shares sufficient money was raised to carry on the development of the mine. The orebody was further proved by drifts and winzes until, in 1909, it was decided to erect a stamp-milling plant.

In order to operate the mine more conveniently, an adit was driven to connect the deepest workings with the surface and an inclined three-compartment shaft sunk from the adit-level on the dip of the ore. Levels were opened up at vertical intervals of 100 ft. below the adit, the shafts being eventually continued to No. 5 level, 500 ft. vertically below the adit. The ore, however, cut out shortly above No. 4 level, or about 650 ft. vertically below the outcrop, and the fifth level was abandoned. All ore mined was trammed to the shaft and from there brought to surface through the adit.

The incline-shaft is of three compartments, 16 ft. 10 in. by 7 ft. 4 in. clear, the inside measurements of each compartment being 6 ft. by 4 ft. 6 in. The sets of timber are of native oak, 8 by 8 inches, spaced at 5-ft. centres. The shaft is sunk at an inclination of 70°. Down to a vertical depth of 330 ft. below the adit, it was sunk in limestone; below it is in hard solid granite. It was sunk entirely by hand-drilling, an average progress of one foot per day being made. Not much water was encountered in sinking and the cost of baling this water was unimportant. It will be of interest to record the cost of sinking this shaft the last 100 ft. of its depth. The following figures do not include foreign supervision. The contract price paid per foot of sinking from No. 4 to No. 5 level was $12.50. This was the highest price paid for sinking, the rate having increased with depth and with the increased hardness of the rock. The whole shaft averaged from $10.50 to $11 per foot sunk, but accurate figures are not available, as the contract rate was altered from time to time to meet the varying hardness of the rock. The contract-price comprises all labor and supplies used, and includes explosives, steel, candles, tools, etc., besides the delivery of all excavated material on the level above and the placing of the timbering.

Cost of Incline-Shaft at Suan Mine per 100 Feet Sunk

		Total cost
Mining [illegible] for sinking @ $12.50 per foot		$1,250.00
Timber (per set):		
[illegible] 33 ft. two-second plates 16 ft. total		
40 ft. [illegible]	$1.67	
Two dividers 12 ft. 6 in. of 6 by 6 lumber @ 6½c...	0.81	
Eight posts 6 ft. [illegible]	3.84	
Carpenters and [illegible]	1.00	
[illegible] sets at per set	$7.82	156.40
One [illegible] 8 in. by 1½ in. by 5 ft. 60 pounds per set @ 7½c	4.50	
[illegible] 20 sets @ $4.50		90.00
Back runners, 400 ft. of 4 by 4 @ 4c. per foot.....		16.00
Ladders 100 ft. @ 5c. per foot		5.00
Incidentals		200.00
Rails: 200 ft. of track at 50c. (purchased second-hand)...		100.00
Total cost per 100 ft.....		$1,817.40
Or, per foot of shaft sunk.....		18.18

Foreign supervision and incidentals brought the final cost up to $20 per foot.

The shaft has two hoisting-compartments and a third compartment for a ladder-way and for the air and pump mains. The pockets on each level have a capacity of about 150 tons of ore. Hoisting is done in 1½-ton skips, which dump into an underground bin cut in the limestone at the head of the shaft, whence it is drawn and trammed to the sorting-house on the surface. The adit is driven at an inclination of slightly less than 1%.

When stoping operations were started in the Suan mine, the large size of some of the orebodies, which, in places, called for stopes nearly 100 ft. wide, made it appear that square-set timbering would have to be employed, and in the beginning this method was adopted to a limited extent. The scarcity and high cost of suitable timber and the difficulty of obtaining an adequate supply of straight sticks of sufficient diameter, and the bad transport conditions then existing, making it impossible to bring in a supply of timber from more distant sources, soon made it apparent that some other system of stoping would have to be adopted.

The walls of the orebodies in this mine were found to consist of a hard and durable limestone, which formed exceptionally good standing ground. The dip of the oreshoots was fairly steep, averaging from 70° to 80°. The ore itself, although comparatively soft in places, was generally hard and firm, and stood well without supports. These conditions resulted in the decision to mine the ore by shrinkage-stoping. The bulk of the ore mined in the Suan has been won by this method.

As the workings progressed it was found that bulges and irregularities occurred in the walls and also unsuspected 'horses' or 'floaters' of limestone were present in the orebodies. However, we adhered to the shrinkage system until the final stages of mining operations, when it was found not only necessary, but more economical, to fill the stopes closely with waste and carry the ore-passes through the filling.

With the further development of the mine it was found that the two main orebodies were separated by a rib of limestone, which proved to be wedge-shaped and tapered out in depth. The strength of the walls was over-estimated and not enough filling was run into the empty stopes, with the result that, as the mine workings reached the final stages, some serious caving occurred and the winning of the remaining ore in the mine was attended with increased cost. The recovery of the unsupported arches, many of which were found to be caved, was only accomplished with a great deal of risk and difficulty, although happily without accident.

In the light of the information now available it would have proved more economical to have worked the mine by keeping the stopes closely filled with waste, carrying ore-passes through the filling, as was done in the final stoping operations at Suan and has also been adopted in the Tul Mi Chung mine where conditions admit of it. This system involves more handling of the ore in the stopes than in shrinkage-stoping, but with the cheapness of Korean labor this is not so serious an item as was at first supposed. One great advantage in favor of shrinkage-stoping is that it permits the accumulation of a

[illegible] of broken ore in the stopes and allows of a [illegible] supply of ore to the mill than is possible [illegible] that are kept filled with waste to the level at [illegible] being stoped. One great disadvantage of [illegible]stoping as the mines on the Suan Concession, and probably in other limestone-replacement deposits, is that ore frequently runs off into the walls, especially [illegible] in bunches and stringers that sometimes lead to extensive additions of ore, with but little evidence of [illegible] showing on the wall of the stope. In shrinkage-stopes these signs are liable to be overlooked. Where stopes are kept filled with waste there is much better opportunity of following such stringers and prospecting the walls, and it has been found that this practice has in several instances led to the discovery of unsuspected extensions of the irregular orebodies that possibly would have been missed in a shrinkage-stope. The waste from the prospecting of the walls and the 'floaters' of barren limestone can be used as filling, whereas this material had to be mixed with the ore in shrinkage-stopes and was only partly eliminated by subsequent hand-sorting on the surface, the grade of the mill-ore suffering in consequence.

In opening up a stope for shrinkage-stoping, a sill-floor is first of all cut on the level to the full horizontal area of the orebody. Over this sill an arch about 10 ft. thick is left, through which the ore-chutes are carried. These chutes are usually 25 ft. apart. The ore is mined as a flat-back stope over the whole width, broken ore being drawn off to preserve sufficient room to allow the miners to continue working on the back. As the stope approaches the overlying level, an arch, about 10 ft. thick, is left to maintain the safety of the workings. The final winning of these arches was costly and dangerous owing to the caving, and it would probably have proved more economical in the long run to have completely excavated the blocks of ore in the first instance and filled the stopes, except on the adit, where, by leaving the level intact, surface seepage through the old Korean diggings was tapped and prevented from flowing into the lower workings. During the stoping, access was obtained through winzes from the level above, and these served later as passes for dumping waste into the empty stope.

The operation of the Suan mine did not involve features that call for special mention; it followed general practice. The main levels are 100 ft. apart. Drifts and cross-cuts are driven about 7 ft. high by 5 ft. wide. Ore-chutes are generally about 25 ft. apart, and, owing to the size and irregularity of the stopes, it was frequently necessary to use stope-drifts and raises for chutes. In sinking winzes, buckets and hand-worked windlasses were first adopted, and, later, Holman stretcher-bar hoists. The tracks in the Suan mine have a gauge of 18 inches and in the Tul Mi Chung 24 inches.

The Suan is now approaching exhaustion after having produced to the end of 1918, 588,199 tons of ore for a total yield of $5,609,524, equivalent to a yield of $9.54 per ton of ore mined. The Tul Mi Chung is now the main producing mine on the Concession, milling operations having commenced in October 1915. From that date the mine has been in continuous operation, and produced to the end of 1918, 437,778 tons of ore for a total yield of $3,107,740, or at the average rate of $7.10 per ton of ore.

The orebodies in the Tul Mi Chung, and also in the adjoining Tong Ahm mine, which has recently commenced steady production, are much more widely scattered than those of the Suan; they are also more irregular in their occurrence and usually have weaker walls, and generally present greater difficulties in mining. One main point of difference, which has an important bearing on the cost of mining, is that while the dip of the Suan orebodies was as a rule fairly regular and steep, averaging about 70°, the Tul Mi Chung orebodies usually dip at a much flatter angle and in many cases ore and waste will not flow in the stopes, necessitating much shoveling. While some of the orebodies occur wholly in limestone, as at Suan, about one-half the ore mined to date is found at the flatly-dipping (about 30°) boundary of limestone with overlying schist. This schist usually forms bad standing ground, and in such cases the stopes have to be closely timbered and kept filled. Square-set timbering is adopted in about one-half the stopes in the mine and the other half is mined without timber supports. The square sets consist of round legs of fir, of 10 in. diameter for posts and 12 in. for caps. This timber is obtained from the forests on the upper reaches of the Yalu river, which forms the frontier between Korea and Manchuria. The timber comes in straight lengths, but is lacking both in strength and durability, and the average life of such a stick in the mine is only three years, after which it deteriorates rapidly.

The square-set stopes are started from sills on the floor of the level and carried right through to the level above. The stopes are closely filled, the timbering kept as close as possible to the back. Formerly the practice was to keep the square-set stopes filled with broken ore and when a stope was worked out to the level above, it was drawn from one end and filling run in as the ore was drawn off in advance of it. This method had to be abandoned because the timbers would not stand unsupported, and the practice now is to keep the square-set stopes completely filled up with waste all the time, leaving only one row of sets at the back of the stope open. The stope starts from a raise at one end and advances the whole width of the stope; and as the ore is passed down, the sets are kept filled behind with waste.

The schist makes a heavy hanging wall and if not well supported is liable to come away in large blocks. In such cases, where the walls were regular enough and the dip sufficiently steep to allow of it, shrinkage-stoping was adopted, but this system has now been replaced by filling the stopes with waste and establishing ore-passes. One important reason for this change is to allow of thoroughly prospecting the walls for extensions of the ore as the stope progresses upward and to make certain that 'false' walls are not mistaken for the true walls of the orebody. The foot-wall of the Tul Mi Chung lode

is quite irregular and ore in places follows slips into the wall. Not only this, but some of the orebodies contain sheets of barren limestone as well as the more common 'floaters', the disposal of which presents difficulty in shrinkage-stoping. In flat orebodies a method of stoping somewhat resembling the long-wall system of coal mining is adopted. Wheelbarrows are largely used for moving waste and ore in the stopes. In filling flat stopes, a great deal of dry-walling is used, Koreans being adepts at this work.

The Tul Mi Chung mine is opened up by means of a main adit, as at the Suan, and the bulk of the ore mined has been won from above the adit. Below the adit the workings have been extended by means of drifts and winzes to a vertical depth of 500 ft. No main shaft has been sunk in this mine yet, but one is now planned. The orebodies are so erratic and spread over such a wide area that the location of a shaft or shafts is a matter of difficulty. So far, the extension of the orebodies horizontally has been greater than the extension in depth and consequently the stopes are spread over a considerably larger area than is usual in mining, necessitating a heavier expenditure in equipment, such as track, air-mains, etc., and the distances that ore and waste have to be trammed underground is excessive. The distance from the south end of the Tul Mi Chung to the north end of the Tong Ahm, which is an extension of Tul Mi Chung, is approximately 4000 ft. and from east to west the Tul Mi Chung workings extend irregularly over a distance of approximately 2000 feet.

From the foregoing it will be seen that the two main features in operating this mine lie in the selection of the most economical method of stoping the ore, varying this method to suit the irregularity of the orebodies, and the question of underground development, which is really underground prospecting. The mine is a network of faults and slips, any one of which might lead to an orebody. It is out of the question to follow up all these, and considerable local experience is required to determine which ones present sufficient promise to warrant the cost of exploring them. About 2000 ft. per month of underground development work is done at the Tul Mi Chung and Tong Ahm mines. Perhaps the outstanding characteristic in the underground development of irregular orebodies of this type is the large amount of cross-cutting required to explore the ore-channels, the cost of which forms about one-third the total cost of mining.

The amount of pumping required is small, except in the rainy season, when a good deal of surface water finds its way into the mine. Speaking generally, the mines are not excessively wet.

Owing to the large area over which the workings extend, a great deal of underground tramming is necessitated, but the cost of it is exceptionally low. At the Tul Mi Chung all the track is laid with a 2-ft. gauge. Cars are of the U type, and of one-ton and two-ton capacity. The following figures will afford an illustration of the average cost of tramming by contract. At the Suan mine the ore is loaded into trucks at the shaft-bin and trammed to the sorting-shed on the surface, a distance of 1980 ft. The cars hold 1500 lb. of ore and require one trammer apiece. The bearings on all cars are of the ordinary plain type. Gauge of track, 18 inches. A single track is laid for the whole distance. The sorted ore is dropped into an underground bin from which it is loaded in cars that hold 2000 lb. of ore, and trammed a distance of 2766 ft. to a second underground bin. For this distance cars are run coupled three together with one or two trammers in charge of the brake. The empties are returned by mules. It requires two men to tip the cars. From the second underground bin, the ore is loaded into cars that hold 4000 lb. and trammed 1600 ft. to the mill. Two trammers are required for each car to brake, tip the cars, and return the empties. The total distance is 6346 ft. and the cars have to be loaded and dumped three times. The contract price is 7½ cents per ton of ore trammed.

At the Soetarie mine the ore is trammed over a single 18-in. track, level for the greater distance, 7238 ft. from mine to mill. Cars are loaded and dumped three times. The cars hold 4000 lb. and are drawn by mules. The contract price is 7½ cents per ton of ore trammed.

At the Tul Mi Chung the ore is trammed by hand from the mine-chutes for an average length of 2000 ft. to the adit-portal. Each car holds 4000 lb. of ore and is provided with roller bearings. The gauge of the track is 2 ft., and 25-lb. rails are laid. From the adit-portal to the mill-bins the cars are hauled by mules over a double-track level road a distance of 3300 ft. The total average distance trammed is a mile, and the contract price, which includes loading and tipping cars, is 4½ cents per ton of ore.

Practically all stoping is done by machine-drills and development by hand-drilling. In stoping, Ingersoll-Rand Butterfly stopers and Jackhamer drills are almost universally used. Koreans make excellent drill-men. In the small amount of development done by machine-drills, Siskol piston-drills and Jackhamers are used. The bulk of the work is done in rather hard limestone. The average rate of progress in drifts and winzes is as follows:

Monthly Rate of Progress of Developments

	—By machine-drills—		—By hand-drilling—	
	Ft	Average, ft	Ft	Average, ft
Drifts	50 to 120	70	15 to 50	30
Winzes	30 to 60	40	15 to 35	25
Raises	40 to 90	60	20 to 40	30

A great deal of mining work, especially development, is done on contract. The average rates are given hereunder. These rates include all labor, explosives, candles, steel, tools, except machine-drills, where such are used, the tramming of all ore and waste to the nearest chutes or to surface, the hoisting of material in winzes, and, where necessary, the placing of timber supports. The company provides any timber necessary, and does all the drill-sharpening. The Korean contractor works as his own shift-boss and engages and pays his crew. The development work is carried out in ground that varies from hard massive granite, very hard garnet contact-rock, and rather hard limestone, the last predominating.

	Per foot	Average
[illegible]	$[illegible] to $4.50	$4
[illegible]	4.00 to 6.00	5
[illegible]	2.50 to 4.00	3

The average total cost per foot driven or sunk, including all costs, for 15,782 ft. of development work done in the Tul Mi Chung mine during 1918 was $4.07.

DAY'S PAY FOR STOPING AND FILLING—1918

Stoping

Rate	[illegible]	[illegible] Machine	[illegible] Hand	0.35c Timber	0.20c.	[illegible]
Month	[illegible]	man	[illegible]	man.	Coolie	[illegible]
[illegible]	[illegible]	1,493	250	176	[illegible]	[illegible]
[illegible]	[illegible]	1,526	230	178	[illegible]	11,495
[illegible]	[illegible]	1,536	111	170	[illegible]	11,792
[illegible]	[illegible]	1,[illegible]	[illegible]	177	[illegible]	11,540
[illegible]	[illegible]	1,458	[illegible]	[illegible]	[illegible]	12,716
[illegible]	[illegible]	1,251	[illegible]	203	1,432	12,570
[illegible]	[illegible]	1,571	[illegible]	179	1,882	13,274
[illegible]	[illegible]	[illegible]	[illegible]	169	1,577	[illegible]
[illegible]	[illegible]	1,128	[illegible]	176	[illegible]	11,917
[illegible]	[illegible]	1,139	[illegible]	174	[illegible]	11,422
[illegible]	[illegible]	[illegible]	398	[illegible]	760	11,729
[illegible]	[illegible]	1,550	1452	236	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	2262	20,389	148,111
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cost per ton	[illegible]	0.0341	0.0081	0.0054	0.0275	0.0832
Tons broken per man per shift						3.1138

Filling

Rate	0.375c.	0.30c Machine	0.25c. Hand	0.20c.	
Month	Boss	man	man	Coolie	Tons
January	[illegible]	322	133	982	5318
February	[illegible]	[illegible]	98	760	[illegible]
March	86	[illegible]	318	1081	8273
April	39	272	22	295	5825
May	56	172	101	769	4728
June	[illegible]	230	188	782	6691
July	69	199	186	500	[illegible]
August	[illegible]	315	316	515	[illegible]
September	85	189	500	180	[illegible]
October	137	280	1048	139	9628
November	70	220	650	435	8868
December	47	[illegible]	233	422	8840
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	2729	3823	6860	[illegible]
Cost per ton	[illegible]	0.0095	0.011	0.0158	0.0403
Tons per man per shift					6.0425

CONTRACT LABOR FOR STOPING AND DEVELOPING—1918

Stoping

Rate	0.375c.	0.30c. Machine	0.35c. Timber	0.20c.	
Month	Boss	man	man	Coolie	Tons
[illegible]	[illegible]	988	[illegible]	799	5300
February	81	1186	17	[illegible]	4610
March	93	877	28	417	3025
April	60	647	11	[illegible]	1640
May	93	800	62	124	1640
June	90	918	54	230	2785
July	122	708	57	169	2425
August	180	1801	36	450	4987
September	180	1759	33	457	3500
October	188	1897	65	506	5429
November	[illegible]	[illegible]	[illegible]	207	1750
December	[illegible]	974	38	902	[illegible]
[illegible]	[illegible]	13,314	[illegible]	[illegible]	39,246
Cost per ton	$0.0122	0.1018	0.0041	0.0266	0.1447
Tons [illegible] per man per shift					1.9352

Developing

Rate	[illegible]	0.375c [illegible]	0.25c.	0.20c.	Feet [illegible] or driven
Month	Boss	smith	Miner	Coolie	[illegible]
January	[illegible]	[illegible]	5005	8319	[illegible]
February	108	[illegible]	5352	2090	996
March	[illegible]	186	[illegible]	2069	1202
April	[illegible]	[illegible]	4740	2143	1079
May	[illegible]	[illegible]	4858	2205	1254
June	170	170	[illegible]	[illegible]	987
July	180	[illegible]	[illegible]	1750	1088
August	[illegible]	[illegible]	4985	2380	1373
September	[illegible]	120	[illegible]	2747	[illegible]
October	[illegible]	[illegible]	[illegible]	3263	1570
November	[illegible]	120	[illegible]	[illegible]	[illegible]
December	[illegible]	[illegible]	[illegible]	[illegible]	1619
[illegible]	[illegible]	[illegible]	58,572	30,093	15,782
Cost per ft.	$[illegible]	[illegible]	1.1134	[illegible]	[illegible]
Feet [illegible] per man per shift					0.[illegible]

The cost and amount of [illegible] that was used at the Tul Mi Chung during 1918 for stoping on day's pay, stoping on contract, obtaining and tramming waste-filling from surface to stopes, and for development work, is shown by the following tabulation, which forms a good average of the amount and cost of labor used in the stoping, development, and stope-filling on this mine. The tabulations cover labor only and do not include any supplies. Practically all stoping is done with machine-drills and all development work by hand-drilling.

It should be noted that the above costs, and other cost figures given, refer to 1918, during which year the property was operated under adverse and abnormal conditions owing to the War. The total operating cost for the year, during which 201,151 tons of ore was milled, amounted to $4 per ton as compared with $3.46 in 1917.

The air-compressing plant at the Suan mine consists of a steam-driven Ingersoll-Rand type XI compressor of a capacity of 570 cu. ft. of free air per minute, and an Ingersoll-Rand Imperial type XB2 electrically driven compressor of a capacity of 1200 cu. ft. of air per minute. Only the latter machine is in use at present. At Tul Mi Chung there are two similar electrically driven compressors in operation. The main air-lines are of 8-in. diameter with branches of 4-in. diameter and from these pipe-lines 3, 2, 1½, and 1 inch are led to the working-faces. Well-fitted blacksmith-shops and machine-shops are provided. Drills are sharpened by Leyner machines. Owing to the distance from manufacturing centres a good deal of the mine equipment is made at the mine. The pumping equipment at Tul Mi Chung consists of one No. 9-B Cameron sinking-pump and three 4 by 6 by 4 in. Worthington duplex pumps at the sumps. As stated before, the mine is not a wet one and these pumps are in operation for an average of five hours per day, except in the wet season, when it is necessary to keep them in operation for 12 hours per day. All pumps are driven by compressed air. The explosive used is gelignite. All loading and firing of holes is done by Koreans.

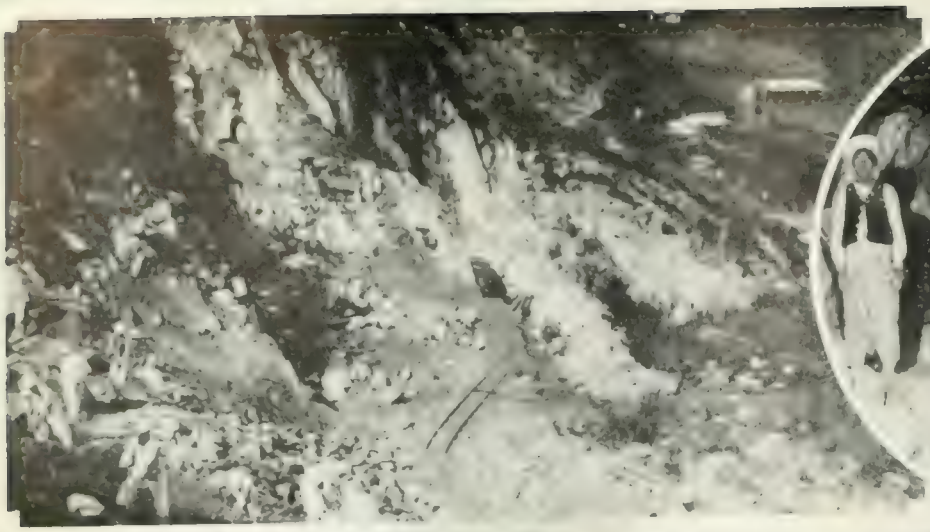
(To be continued.)

BACTERIA evidently not only aid in the decomposition of rocks and in the formation of beds of chalk and limestone, as has recently been demonstrated, but are active agents in the deposition of some beds of iron ore. Engineers have learned that iron-depositing bacteria may be troublesome pests through their ability to clog the pipes of city water-supply systems with hard thick crusts and slimy rusty masses composed of millions of individual bacteria. E. C. Harder, of the U. S. Geological Survey, who has examined deposits of iron ore in many countries for the special purpose of determining their mode of origin, has recently made close studies of the action of bacteria in forming iron ores. He has found the so-called iron bacteria actively engaged in the deposition of compounds of iron not only in surface iron-bearing waters but in mine waters to depths of several hundred feet and has made laboratory cultures of various iron-depositing bacteria. The results of these studies have just been published by the Survey as a paper entitled 'Iron-depositing bacteria and their geologic relations.' (Prof. Paper 113.)

The Staff of the Seoul Mining Co. H. R. Bostwick in Centre, A. R. Weigall on His Right, J. F. Mitchell-Roberts on His Left

A Poultry-Seller

Tul Mi Chung Mill and Power-Station



Outcrop of the Sang Dei

Sang Dei Mine

Tai Mi Chung Club and Bowling-Alleys

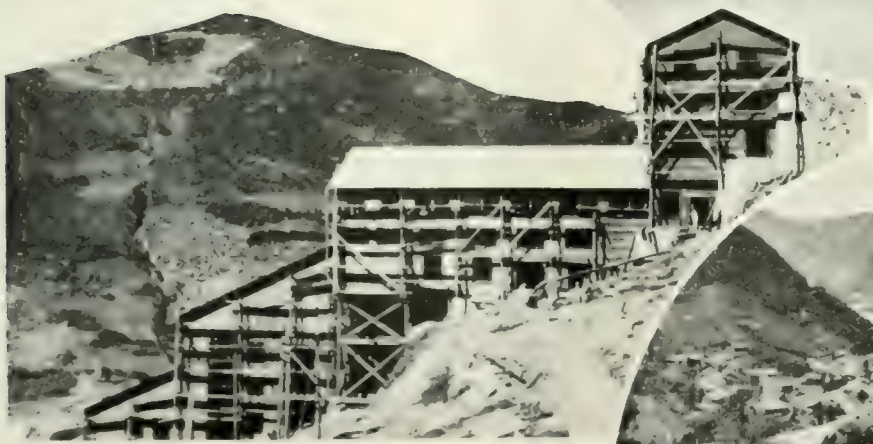
Topography Along the Contact

The Miners

The Foreign Residences at Tal Mi Chuan

The Mill at the Tailings-Dam

The Portal of the Main Adit



The Mill During Construction

The Mine in 1918

The Main Office

Suan Mine in 1909

The Main Portal

Suan Mine Today

Camp at Suan

Main Office

The Suan Mill

CALIFORNIA

SIERRA COUNTY, GRASS VALLEY, NEVADA CITY.

SIERRA COUNTY.—Visible gold and sulphides have been found in a cross-cut in the Oro mine at Downieville. While driving a tunnel the past few months small bunches of rich ore have been found and it is believed from this showing that this is another feeder leading to the main vein some distance farther east. The Oro is being developed by Dr. Reynolds and others of Alameda. Work of the City of Six, in Chug canyon, has ceased for the season. The tunnel was advanced 150 ft. this summer. Raises and winzes along the serpentine foot-wall every 75 ft. have exposed a vein 3 ft. wide of ribbon-quartz panning free gold and arsenical sulphides of an estimated value of $15 per ton. A tunnel lower down is in 1150 ft. The end of the tunnel is 350 ft. below the surface. By a recent decision in the U. S. Circuit Court of Appeals at San Francisco the Sixteen-to-One Mining Co. has been awarded $93,000 from the Twenty-One Mining Co. at Alleghany on the ground of trespass by the latter. The litigation extended over several years.

GRASS VALLEY.—The first unit of the restraining dam at Bullard's Bar on the Yuba has been completed. Electrical machinery is still arriving at the Idaho-Maryland. The Pacific Gas & Electric Co. has petitioned the Railroad Commission to compel the North Star Mines Co. and the Empire Mines Investment Co. to make a change from water to electric power. Both these companies have operated for years on water-power and erected plants costing thousands of dollars, all of which would be worthless should the proposed change be carried out.

NEVADA CITY.—A merger of the Banner, North Banner, and Central claims near Nevada City has been effected under the name of the Central Consolidated Mines Co. and a permit granted to sell 300,000 shares of stock. The mines were formerly producers, but have lain idle for many years. W. J. Webster, of the Atlas Power Co., is president of the new company.

COLORADO

CRIPPLE CREEK, TELLURIDE, PARADOX VALLEY.

CRIPPLE CREEK.—Directors of the Portland Gold Mining Co. have declared the regular quarterly dividend of 2 cents per share, payable on October 20 to stockholders of record October 11. The amount, $60,000, will bring the total sum paid to stockholders up to $11,499,080. The Portland dividend, together with the dividends of $45,000 of the Golden Cycle company and $15,000 of the Vindicator Consolidated, mentioned in our last issue, will bring the total of October distributions to $120,000.

A vein in place, with promise of permanency, has been opened on Carbonate hill, north of the city of Cripple Creek and but a short distance beyond its northern boundary, by John L. Macdonald, an old-time prospector who has persistently prospected this region for about a quarter of a century with but small profit. While prospecting east of the Laura Lee on Mineral hill, and the Elkhorn on Carbonate hill—both small producers of high-grade ore, but now inactive—Macdonald uncovered at surface, under a large boulder of float, a quartz vein more than three feet wide, showing rusty gold. Samples have assayed 15 oz. gold per ton. The boulder of quartz, which weighed about half a ton, was broken and found to be liberally peppered with both rusty gold and sylvanite.

The shortage of miners has been accentuated by nearly two score men leaving last week for the Caribou district, where a higher scale of wages obtains. More than twenty men were induced to leave the Portland mine alone, and it is expected that the October production will be curtailed accordingly.

TELLURIDE.—Anticipating heavy shipments during the winter and early spring, the Rio Grande Southern R. R. is to undertake the tunneling of the Ames Slide, for the purpose of draining this obstacle to traffic. Bids have been invited from mining men familiar with the problem. The draining of the huge mass of ground was decided upon as the best method of overcoming the difficulty, after a consultation with mining men of the vicinity. The Ames Slide is a block of ground a quarter of a mile long, three-quarters of a mile wide, and ranging in depth from twenty to several hundred feet. As this mass of ground accumulates the melting snow-water from the higher slopes, it becomes a creeping avalanche of mud, continually encroaching upon the railroad tracks at its lower edge, and only by the continual use of steam-shovels is the track kept clear. The cost of holding the slide in check is estimated to have totaled $50,000, extended over a period of years. The plans for avoiding this call for driving a tunnel into the slide at some point near the middle, drifts on each side of the main tunnel for a short distance, and a raise at the termination of each drift. It is expected that this system of drainage tunnels will dry out the entire block of ground, stopping the movement permanently.

Baril & Co. have leased the Crown Point from J. M. Belisle. Excavation for the foundation of the Valley View Leasing Co. mill, at the San Bernardo mine, is now under way, and the Rio Grande Southern is putting in a

sole load to the mine. The Belmont Wagner Mining Co. is working 150 men at the mine and mill. A large storage reservoir is being constructed. The Little Bessie mine is under lease and option to T. M. Long, under a two-year agreement, with the option of an extension for another two years. This property is owned by the Basset company, of Bridgeport, Connecticut, and the Adams Express Company.

Paradox Valley.—All producing companies continue to extend their operations and to ship more heavily. New claims are constantly being developed. A shortage of labor still handicaps operations, but the general condition of roads is good, and the ore is transported without difficulty. The number of trucks hauling the ores is being increased; at the present time there are 40 trucks in operation. The demand for ore is so urgent at the Montrose reduction plant that a night line of trucks is running to supplement the day haulage. The Vanadium Company of Colorado continues to dismantle the Old Sampsons mill. The superstructure of the new reduction-plant is completed and the foundations for the machinery are now being laid; some machinery is already in place. The mill of the Primos Chemical company at Vanadium is nearing completion. Old machinery salvaged from the fire is being erected. The Standard Chemical Co. is still short of men, 75 being needed for the Carnotite mines. Two 6-cylinder 200-hp. engines are being erected at the Navajita plant. The W. L. Cummins Co. of Lansdowne, Pennsylvania, is opening up Bull Canon holdings. O. B. Williamson, local manager, is buying up a number of claims for the company, and thirty claims are now held.

MICHIGAN

HANCOCK CONSOLIDATED RE-OPENING.—INGOT COPPER PRODUCTION.

There has been a slight increase in the copper production of most of the mines of this district, but the output is not yet at normal. The most important event of the week was the re-opening of the Hancock Consolidated property in charge of Clyde Weed. This opening receives its importance from the fact that John D. Ryan, of New York, controls the Hancock property. The presumption is reasonable that Mr. Ryan would not order the Hancock to re-open unless he looked for a betterment in the copper metal market within 90 days at the outside, and Mr. Ryan is looked upon as having an accurate view of the general metal market. The Hancock Consolidated is the only property in the Michigan district in which Mr. Ryan is interested. Years ago his father tried without success to make the Hancock pay. The Hancock remained idle for 10 years, when it was resuscitated. John Godfrey is the president of the present operating company. The efforts to make the Hancock pay have so far failed, but many assessments have been levied on the shareholders. When the slump came in the copper market last year the Hancock was the first mine to suspend. In the meantime the company sold mineral land to the Quincy for $225,000, which will provide sufficient funds to resume operations. The work now will be directed to developing sufficient ore so that when shipments of ore do actually commence again the property will be in position to maintain a reasonable tonnage to the mill. The quality of the Hancock ore has been good enough to assure remuneration to the shareholders if the tonnage could be put up to 1000 daily. Hancock sold 200,000 lb. of copper for 22c. 40 days ago.

Of particular interest to engineers is the water intake tunnel which the Mohawk company is running out into the lake at Gay, the site of their stamp-mill. This tunnel now has attained a distance of 1920 ft. It has to run another 900 ft. before the terminal is constructed.

Calumet & Hecla's haulage lateral will have its terminal at No. 7 shaft, Hecla, which will be reached within 50 days. Then it will extend to No. 12, South Hecla. It will, of course, take in the North Tamarack shafts, now part of the Calumet & Hecla mine proper. Calumet & Hecla now is running 20 heads three shifts per day, handling 7500 tons.

Franklin cross-cut to the vein ought to get into copper November 10. It has 40 ft. yet to go. Following this opening in the lode the shaft will be extended to the 41st level and the vein will then be tapped by a cross-cut from that point.

The production of ingot copper from the mines of the Michigan copper district for the month of September 1919 was 14,997,529 lb., a decided increase over the output for August month, when it was 13,302,866 lb., and a material increase over the showing for July. At the same time the production is far from normal, 80% being a liberal interpretation of the figures.

The outstanding feature of the monthly showing is the doubling of the production of the Mass Consolidated, that Ontonagon property going from 100,000 lb. to 200,000 lb. in one month. Another conspicuous showing is made by the Allouez. While this mine increased its copper output by more than 50%, the most important betterment was shown in the copper content of the ore, the showing for September being 24 lb., compared with 18 lb. per ton for August. Similarly there was a betterment in Centennial of 3 lb. per ton.

The following is a tabulated statement giving the results in actual copper produced at all the mines of the Michigan copper district. For some of the mines the figures are official smelter and mine records; for others they are estimates, but the approximations are conservative in each instance.

Mine	Ore tonnage	Lb. per ton		Refined	
		Sept	Aug	Sept	Aug
Allouez	61 720	22.3	22.2	1 378 987	1 245 300
Arcadian	15 210	21	18	302 562	245 800
Baltic	25 000	35	34	875 000	680 000
Calumet & Hecla	180 017	25	25	4,501 164	4 136 818
Centennial	5 625	16.8	13.9	95 050	70 500
Champion	13 000	40	40	1 700 000	1 800 000
Isle Royale	60 579	18.5	18	1 287 228	1 059,583
Mass Cons.	13 133	15	14	200 000	100 000
Mohawk	5 300	30	32.2	165 000	161 254
Quincy	14 178.8	22.16	21.36	979 339	922 209
Ontonagon Cop.	54 000	15.7	14.4	849 100	817 000
Quincy	94 444	18	18	1 700 000	1 620 000
Trimountain	14,000	26	25	364 000	350 000
Superior	.....	..	17	14,000	11,000
Victoria	10 160	13	12.5	136 000	130 000
Wolverine	26 585	14.55	14.65	386 899	402 822
La Salle	540	..	..	No refined output	

NEVADA

SHIPMENTS FROM THE FLORENCE DIVIDE LEASE.—LABOR SITUATION AT TONOPAH AND DIVIDE.

GOLDFIELD.—Smelter returns from the shipment made in August by the Florence Divide lease on the Florence Goldfield show the value of the shipment to have been $93,553. There was 368 tons of ore of an average value of $254 per ton. Transportation charges amounted to $5865, including $2545 for the ore shipped by express. Treatment charges were $4231, making the total transportation and treatment charge $10,096 and leaving a net return from the smelter of $83,457, of which the lessee received 75% and the parent company 25%. The shipment was divided into 15 lots, seven of which were umpired, with the result that the value was raised $500. Eight carloads shipped in bulk had a value of $31,249. Three lots of about 10 tons each were worth a total of $44,953. The richest ore consisted of 3492 lb., assaying $9935 per ton, or a total of $17,351. H. G. McMahon, secretary-treasurer for the Goldfield Development Co., is in New York to assist A. I. D'Arcy, vice-president and general manager, in closing negotiations whereby the company is to receive $300,000 to be used in enlarging the mill to 2000 tons daily capacity and in exploration of the mines controlled by the company aside from the Combination and Red Top, which are now in condition for production. Much of the mine development to be done with this money will be in the Jumbo, where it is believed there are important possibilities for opening low and high-grade ore toward the boundary line of the Cornishman claim of the Florence, where the principal early-day work was done by lessees. The Red Hill is saving ore for shipment in the south drift on the 500-ft. level. The shoot is from 12 to 18 in. wide and the average value of the ore as broken for the width of the drift is $17. Assays of as high as $240 have been obtained from narrow seams of quartz in the shoot, which has been driven on for 75 ft. The face of the drift is estimated to be 650 ft. south of the Florence fault in the Rogers vein, beyond which geologists have predicted ore will not be found. Both the Red Hill and Florence are searching for orebodies south of this fault. The cross-cut to the vein at a depth of 420 ft. in the Cracker Jack has been driven 90 ft. and the face still is in foot-wall material. The vein should be cut within a short distance. The east cross-cut on the 252-ft. level of the Lone Star has been driven 458 ft. from the shaft and the face is now in andesite, indicating the approach to the vein, which is the objective of the work. This vein, which is supposed to be the same that produced $70,000 in the adjoining Commonwealth, has been exposed on the surface of the Lone Star claims for a width of from 9 to 12 ft. and for a distance of 700 ft. A cross-cut has been started on the 252-ft. level toward the downward extension of the ore-shoot in the Lone Star from which $30,000 was shipped by the Patrick lease. This is the first attempt to reach

A VIEW OF MOUNT WILSON, IN THE SAN JUAN REGION, COLORADO

under this ore shoot. The south drift from the Hartley shaft in the Examiner claim has been driven 74 ft. and a cross-cut has been extended 48 ft. from it to explore the shale foot-wall of the vein. The surface of the Examiner and Blue Grass claims are being prospected.

DIVIDE. What is believed to be the continuation of the Divide Extension Caldwell shaft vein has been opened at a depth of 55 ft. in the White Caps claim of the Dividend. The shaft in which the discovery was made is 400 ft. north of the Caldwell shaft. An assay of $57.70 was secured from a 6-ft. width. Seams of quartz have been exposed in the cross-cut being driven on the 400-ft. level of the Divide Extension main shaft to intersect the downward extension of the orebody opened at a depth of 100 ft. in the Caldwell shaft, indicating that the vein is being approached. Ore assaying $19 per ton over a width of 6 ft., with seams showing horn silver, has been found in the Kernick vein in the Hasbrouck tunnel. The labor situation is improving rapidly in both Divide and Tonopah, but just what the operators eventually will do remains to be seen. The Divide operators seem anxious to give the men a 50-cent increase and a co-operative store and get things there on a sound basis, but the Tonopah operators do not seem to care in particular whether their mines re-open or not, and they undoubtedly oppose concessions at the frequent meetings being held in Tonopah.

UTAH

SUIT AGAINST THE SILVER KING CONSOLIDATED.—ACCIDENT AT THE UTAH APEX.

SALT LAKE CITY.—Hearing was commenced in the United States District Court in Salt Lake City on October 16 in the case of the United States against the Silver King Consolidated Mining Co. of Park City (Solon Spiro, president) to collect something over $6400 alleged by the Internal Revenue Department to be due as income tax for the year 1913. The suit hinges on whether or not a part of the revenue of the mining company should have been regarded as taxable income. The complaint alleges that the Silver King Coalition Mines Co. in 1913 paid the defendant company the sum of $641,312 as a judgment for ore extracted from the property of the Silver King Consolidated by the Silver King Coalition. The Government seeks to collect $6413 as an income tax, together with 5% penalty and interest at the rate of 1% per month from June 30, 1914.

BINGHAM.—An unfortunate accident happened in the Utah Apex mine on the morning of October 14. E. Conway Ashton, a member of the law firm of Bagley & Ashton of Salt Lake City, had been retained for some time by the Utah Apex Co. in its suit against the Utah Consolidated Mining Co., which is to come up in the United States District Court November 4. On the afternoon of October 13, Mr. Ashton went to Bingham in company with O. P. Peterson and Albert Burch, geologists, to examine the mine for the purpose of gathering evidence for the case. About 8:30 on the morning of the 14th, in company with the two geologists, V. S. Rood, the superintendent, and John Cooney, the mine foreman, Mr. Ashton entered the mine on a tram-car. About 2000 ft. in the adit the tram-car on which they were riding was struck by an ore-train. All the party, except Mr. Ashton, jumped from the car when the ore-train came suddenly around a rather sharp curve. Mr. Ashton was shaken from the tram-car by the impact with the ore-cars, and apparently broke his neck in the fall. He was immediately removed to the residence of Mr. Rood, and although medical assistance was summoned from both Bingham and Salt Lake City, he failed to regain consciousness and died three hours after the accident. Mr. Ashton, who was but 39 years of age, was one of the most prominent and successful attorneys of Salt Lake City. He is survived by his wife and four children.

WASHINGTON

STEVENS AND OKANOGAN COUNTIES.

STEVENS COUNTY.—The ore which had accumulated in the bins has been shipped by the Electric Point company. This company is considering the installation of a second section of an aerial tramway to ship the entire output of the mine to the railway the full distance of ten miles, and thus reduce the cost of shipping. The mine is operated by shaft and adit openings to a depth of 800 ft. The company has been looking for an increase in the price of lead before shipping a large quantity of available ore. In the Loon Lake district the Loon Lake Copper Co. is developing a new body of ore at a depth of 500 ft. This is believed to be a separate body and not connected with one under development at a depth of 100 ft. It is expected the new discovery will double the present output of ore. It is possible that it may connect with the body of ore which was developed between the 200-ft. level and the surface and paid dividends. It has been cross-cut and found to assay 4% copper. The Colville Valley Coal Co. has erected at Valley a boiler, pump, and air-compressor, capable of driving three or more machine drills. The entries to the mine are at depths of 250, 310, and 380 ft., and the mine is looking well on each level. A dam is under construction, to impound the mine water.

The United Copper Co. shipped in August seven carloads of coarse concentrate, one carload of fine table concentrate, and three carloads of high-grade ore. The concentrate contained 20% copper and 80 oz. silver per ton and had a total value of about $5000. The ore came from stopes on the 1400-ft. level. The gross value of the August shipments was approximately $27,000. Since the latter part of July a raise was carried up 165 ft. from the 1000-ft. level and penetrated a body of low-grade milling ore, which it is estimated will yield upward of 50,000 tons. An orebody 10 ft. wide has been intersected 600 ft. north of the shaft, on the 1200-ft. level. It is of milling grade, with small inclusions of gray copper. Under new management 175 tons of ore has been treated daily in the mill, and it is expected the quantity will be increased to 250 tons daily. The mine and mill now give employment to 87 men. The mill is being operated on three shifts.

OKANOGAN COUNTY.—The mine being operated by Atkins and Grant is on the Alice claim, formerly called the No. 1, and the mill, situated on the Shamrock claims, is grinding concentrate. The Shamrock long since presented a good showing, but the most valuable discovery on this group was recently made at a depth of 55 ft., in a shaft on the Alice claim, where the ore is rich in silver, copper, and lead. No. 1 was prospected twenty years ago in an open-cut and was then considered a rich prospect, but it was neglected because of more important and surer attractions and the lack of reasonable transportation rates. The Copper World Extension mine, in Palmer mountain, has been for some time under lease to Charles Dempster, of New York, who, with two sons, aided by New York capital, has expended $80,000 on machinery, development, and a Riblett tramway for conveying ore from the mine to the base of the mountain.

HYDRAULICKING AT TEN-MILE, IN THE TROUT LAKE DISTRICT, BRITISH COLUMBIA

BRITISH COLUMBIA

NELSON, STEWART, TRAIL, BARKERVILLE.

NELSON.—Hon. William Sloan, Minister of Mines, visited the Slocan district in the course of a tour he has been making of the Eastern mining districts of the Province. He inspected a number of the well-known silver-lead properties of the district, among which was the Silversmith, formerly known as the Slocan Star. Entering on the tenth level, where a good ore-shoot was opened up last year, he explored the workings up to the eighth level. Mr. Sloan reports that the new concentrating plant, installed at Alamo by Clarence Cunningham, is working well. Good progress also is being made on the 200-ton concentrating plant at the Noble Five mine, which is similar in type to that at Alamo. On the Standard, formerly the banner producer of the district, new areas of promise are being developed. The McAllister, Surprise, and Ivanhoe are other prospects mentioned by the Minister as being promising. Mr. Sloan stated that he always had been an optimist where Slocan was concerned and now was more than ever convinced that his faith was justified. Mine operators took advantage of his presence to represent the desirability of the construction of a road connecting the communities of New Denver and Sandon and also of providing means of transportation by wagon-road with Nelson by way of Slocan City. Mr. Sloan expressed his appreciation of the benefit these works would be to the mining industry and promised to do all he could to assist in securing the necessary appropriations.

That immediate action should be taken by the Dominion government toward the establishment in British Columbia of an ore-testing plant is the opinion of members of the Nelson Board of Trade, as well as of the mine operators generally throughout the Kootenay and Boundary districts. The Government already has provided the finances for the enterprise but as yet has taken no steps to construct necessary buildings and install the plant. There has been some discussion as to the most suitable site but it is thought that Nelson, now that it does not seem likely to go to the B. C. University, Vancouver, will be chosen.

STEWART.—The newly organized North Coast Branch of the Canadian Mining Institute held a meeting re-

...ple at Stewart, with Major Angus Davis, general manager of the Dolly Varden mine, as chairman and E. J. Conway, field engineer for the Granby Consolidated Mining & Smelting Co., as vice-chairman. Roy Chidley, of Stewart, acted as secretary. E. E. Campbell, mine manager at Anyox for the Granby company, in the course of an address referred to the awakening of interest in the Portland Canal district and said that he looked to Stewart and the adjacent mineral zone to develop into a really exceptional camp. Although it was not generally known, the Granby Hidden Creek mine was the biggest copper mine in the British Empire. The Dolly Varden, at Alice Arm, was a fine property in a splendid district and he looked for big things there. "I am not given to making prophesies," Mr. Campbell continued, "but I believe that Stewart will become the chief mining centre in northern British Columbia. I traveled all over the North-West from Washington to Alaska when I was in the field for the Granby, and I never saw a district with the possibilities that this has." Speaking of the aims and objects of the Institute and of work which it might undertake, Mr. Campbell mentioned the matter of the removal, or at least the lowering of the tariff on mining machinery. This duty was one of the chief obstacles to development, especially in the early stages, the time when mining property required every encouragement.

TRAIL.—J. J. Warren, president of the Consolidated company, who has been in Europe seeking markets for the company's products, has announced that the demand for zinc in Europe, South Africa, and India is practically unlimited, and that Canada is capable of supplying one-tenth of the world's demand. The condition of the zinc market, in his opinion, would warrant his company in making the necessary expansion to meet this demand. One of the first moves in this direction probably will be the erection of a large concentration plant at the Sullivan mine, at Kimberley, which is the largest zinc producer in British Columbia and is capable of considerable expansion. Last year the Province produced over 20,000 tons of zinc, of which the Sullivan provided 13,300 tons. The ore receipts at the Trail smelter showed a slight falling off for the week ended October 7 owing to the strike at the Sullivan mine and at the North Star mine.

CARIBOO.—A rich discovery is reported to have been made by the Lightning Creek Hydraulic Mining Co., on Amador creek. A shaft was sunk 500 ft. ahead of the working face, and a channel containing heavy-nugget gold was struck. Though it is late in the season, the management expects to make a good clean-up before shutting-down for the winter. Messrs. Roberts and Bryce with associates in Toronto and Cobalt have purchased eight claims near Barkerville for $250,000. Two veins, averaging 17 and 42 ft., respectively, and assaying $17 to $20 per ton in gold, have been exposed at intervals over a considerable length. Tommy Burns, ex-champion pugilist, and J. P. McConnel, late editor of the Vancouver 'Sun', are sinking a vertical shaft at Antler ...

BARKERVILLE.—Placer gold production in the Cariboo district this season has been considerably in excess of that of last and with development promised on the Proserpine Quartz claims, which recently were acquired by eastern Canadian interests, considerable mining activity is assured next year. With reference to the quartz properties, R. A. Bryce, who is in charge of the work of opening them up, states that about forty men will be employed during the winter. Word also comes from Stanley that what is described as an important discovery of gold has been made by the Lightning Creek Hydraulic company, where they are operating above the mouth of Amador creek. The discovery was made by sinking a shaft about 500 ft. ahead of the face. Here they struck a channel apparently overlooked by the old timers. L. A. Bonner, the manager, states that the gold is heavy lead gold and typical of the channel gold of this section. Although the season is well on he expects to make a substantial recovery before operations cease.

ONTARIO

DISCOVERY OF PITCHBLENDE.—HOLLINGER STATEMENT.

BUTT TOWNSHIP.—A discovery of pitchblende has been reported in Butt township in the Nipissing district. It was found by William Elliott, a prospector who had taken out a claim for mica. An assay by Ledoux & Co., of New York, showed the pitchblende to be unusually rich in uranium content of 63.60%. This is the second discovery of radium-bearing mineral reported to the Ontario Bureau of Mines since the Government offered a reward of $25,000 for the first discovery of radium in commercial quantities, the previous find being of euxenite, in Lanark county. In both cases the reward has been claimed, but the matter is still in abeyance as it has not yet been shown that the mineral occurs in commercial quantities. C. W. Knight, of the Ontario Bureau of Mines, who has examined the scene of the discovery, states that the pitchblende was found in a coarse granite pegmatite dike in association with mica, tourmaline, and other minerals in small quantity. The country rock of the region is pre-Cambrian, and is composed of banded gneisses cut by numerous pegmatite dikes which extend over a large area. It is considered possible that they may be found to carry pitchblende or some other radium-bearing mineral in economic quantities.

LARDER LAKE.—The Associated Goldfields Mining Co. is undertaking to mine large bodies of low-grade ore on a scale not yet attempted in Ontario. Its properties comprise about 2000 acres, of which 1600 are mining claims and the remainder water-power rights-of-way. The plan of development is to block out the orebodies on three of the properties known as blocks B, C, and D, formerly the Harris-Maxwell, Kerr-Addison, and Dr. Reddick mines, and ascertain the tonnage and its tenor in gold. About $1,000,000 has already been spent on the installation of the water-power plant, erection of buildings and machinery, and development of the orebodies. A shaft has been sunk on block B, a hill of ore 1000 ft. long by 130 ft. wide, to the 500-ft. level, and an adit run directly across

the body at the 100-ft. level. Driving and crosscutting has proceeded at the 500-ft. level, where the orebody proves to be 300 ft. wide. It is stated that the engineers have proof that the ore can be milled at a profit to compare favorably with other mines, and a mill will shortly be erected with a capacity of 5000 tons per day. Block C, several miles distant, is a hill of mineralized rock 1250 ft. long and about 300 ft. wide at the surface, rising 300 ft. above lake level, and proved by diamond-drilling to be 500 ft. wide at the 500-ft. level. It is now being explored by diamond-drilling and surface pitting and blasting. The plans of the company include the erection of another 5000-ton mill to treat the ore from this mine and from Block D, otherwise known as the Dr. Reddick, adjoining, where the ore is stated to be of somewhat higher grade. The Associated Goldfields ore is stated to average $5 per ton.

Skead Township.—An important gold discovery has been made in Skead township, an outlying district of the Boston Creek area, by Walter Manley, a returned soldier. Spectacular gold showings occur in a dike upward of 25 ft. in width composed of altered porphyry intersected with quartz veins. Six claims, which had lapsed owing to the non-performance of assessment work, were restaked by Manley and William Reilly and are known as the Manley-Reilly group. Other discoveries have drawn the attention of prospectors and mining men to this field.

Porcupine.—A statement of the Hollinger Consolidated covering the period from January 1 to September 9 shows a total income of $4,839,845, expenses $2,433,958, and net profits $2,405,887. Dividends amounting to $984,000 have been paid and $1,421,887 added to surplus. The total surplus now stands at $3,493,174. The total number of employees, which stood at 1344 on June 17, was only 1187 on September 9. The cost of treatment of ore per ton was $4.82, as compared with $4.95 for 1918, and the average value of ore treated was $9.99, compared with $10.24 in 1918.

SONORA

NACOZARI CONSOLIDATED DISCOVERS GOOD ORE.—ACTIVITY AT CANANEA.

Nacozari.—An ore-discovery of considerable importance was made in the main working tunnel on the Galera group of the Nacozari Consolidated Copper Co., when the diabase wall of the copper vein toward which the company had been driving for twelve years was struck 4000 ft. from the portal of the tunnel and at 600 ft. vertical depth. A full face of brecciated rock shot with bornite and chalcopyrite, similar to the ore of the Moctezuma Copper Co., whose property adjoins the Nacozari Consolidated, has been opened. At the same time a heavy flow of water, considered certain confirmation of the proximity of the brecciated zone, was struck. This is typical of the district. The water, while not impeding work, because drainage in the tunnel is comparatively simple, guarantees sufficient supply for milling operations. Although every carload of rock brought out of the drift shows copper, it will require between 100 and 150 ft. of driving before the big bodies of ore are intersected, according to calculations of the management. At present engineers are running a survey to determine the exact location of the main breast. It is believed to be about one mile from the mining camp of Pilares and approximately 1000 ft. from the south-eastern corner of the Pilares property of the Moctezuma Copper Co. The Nacozari Consolidated was incorporated in 1907 with a capitalization of $6,000,000. It is a low-grade copper property, the main vein of which is about 600 ft. wide. This is the vein which has just been cut. In addition it has veins of gold, silver, copper, and lead. Underhand stoping, similar to that employed in the Pilares mine, has been adopted. The ground stands well and but little timber is required. In addition to the Galera group the Nacozari Consolidated is working the San Pablo, a small silver property. From this about one ton of high-grade silver ore, occurring in small streaks or veins, is removed daily, together with a considerable tonnage of low-grade milling ore. An average of a carload of this silver-lead ore and concentrate is shipped monthly to the El Paso smelter for reduction. The company has acquired a lease upon the San Pedro group of the Moctezuma Copper Co. and from a ravine in this property has driven a drainage-tunnel to connect with the bottom of the working shaft of the San Pablo. This tunnel, which will be between 1100 and 1200 ft. in length when completed, probably will be finished in a few weeks at the present rate of progress. This will allow the working of the San Pablo on a more extensive scale than ever before. A 150-ton mill, equipped with flotation apparatus, stands upon the property. John G. Alexander, of Douglas, Arizona, is president of the company; Thomas D. East, Trinidad, Colorado, vice-president; Byron R. Russell, Douglas, secretary; Roy Hiatt, Douglas, treasurer; Rufus R. Humphrey, Malone, New York, Reginald C. Heath, Boston, Massachusetts, and George Motz, Douglas, directors. Mr. Motz also is mine superintendent and geologist.

Cananea.—Increased activity is being shown by the mines of this district after a quiescent period of several months. The Democrata Mining Co., owned by the Hoffman interests of Cincinnati, Ohio, C. E. Hoffman, manager, blew-in one furnace of its smelter early in October and resumed mining operations. About 300 men are employed at present. Another furnace will be blown-in as soon as machinery for adding to the power-plant equipment has arrived, which is expected within a few weeks. The Calumet & Sonora, owned by the Norton interests, Mr. Sanford, manager, has resumed operations in both the mining and mill divisions. At present these are on a small scale; it is intended to increase production and force as conditions warrant. This is a zinc-silver-lead-copper property. The Cananea Consolidated Copper Co. is working practically all its mines in the district and employing approximately 3000 men in mining and reduction divisions. In the smelter six furnaces and one reverberatory furnace were in operation the latter part of September. It is understood that it is intended to maintain about the same production this month as last.

SUSPENSION OF ASSESSMENT WORK

Letters from Washington state that it is improbable that the five-claim limitation of H. J. R. 150, suspending assessment work on mining claims for 1919, will be withdrawn. An amendment removing this limitation is now pending, but its chance for passage is so small that miners who hold claims should plan to perform their assessment work in accordance with H. J. R. 150, as it now stands. Under an interpretation of this, made by the Department of the Interior, if an individual, either directly or as a member of an association or a corporation, claims exemption from the performance of assessment work upon five claims in which he holds an interest, no matter how small the interest, he shall be barred from claiming exemption from assessment work upon any other claims he may own in full or in part.

ALASKA

Seward Peninsula.—More than $2,000,000 in gold was mined on the Seward peninsula this year, according to Jafet Lindeberg, president of the Pioneer Mining Co., and one of the discoverers of Nome's gold-bearing sands. This year's output was $750,000 greater than last year's.

Susitna Region.—Fred P. Davy of Seattle has optioned a group of four claims from Dolf Smith and William Trout, situated near the head of the North Fork of Kashwitna river in the Talkeetna mountains. There are two known veins on the property said to occur on or near the contact of the quartz-diorite of the Talkeetna range, with andesitic greenstone, dacites, and rhyolites of the Skwentna group. The prospects were discovered by William Smith in 1904 when the Alaska Northern railroad was projected from Seward, but owing to the failure of the project, nothing was done on the claims. They are now rendered accessible by the Government railroad. Supplies will be freighted from Kashwitna station in March, and exploration and development will follow as soon as weather and climatic conditions permit in the spring.

ARIZONA

Crown King.—Kingdon and Gilbreath have six men working on the Tuscumbia, cleaning out the old drifts.——The Springfield is under lease to the Nelson brothers.——The old Bullybueno gold mine, ten miles north of Crown King, is being worked by M. Roland, of Hooper, under bond and lease.

CALIFORNIA

Engelmine.—J. E. Patrow has started development of promising orebodies on the Lone Rock and Lone Star properties. The mines are about ten miles from the Engels group and contain gold-bearing ore. Carl Johnson, Frank Stevenson, and I. Turner, all of Westwood, are interested in the Lone Rock, which is reported as developing well.

Kennett.—Sixty men are working at the Mammoth mine and four mills are engaged in exploratory work. Shipments of siliceous gold ores continue to arrive from the Reid mine, at Old Diggings, and other properties, and are stored in the smelter yards. There is no indication of an early resumption of smelting.——[illegible] is preparing to re-open the Meeks gold property at Quartz Hill. It has been idle several months.

Klau.—The old Klau quicksilver mine has been taken over by Ellard W. Carson and associates. The plant is being rehabilitated and development work is also under way.

Last Chance.—The Forest Hill Divide is showing much activity. Rich gravel has been uncovered in the Excelsior, at Forest Hill, and the Glenn, at Last Chance, is producing the richest gravel ever found on the property. Frank Tilfoston is superintendent. George McAuley of Auburn, former Sheriff of Placer county, is heavily interested in the Excelsior and Gem.

Murphys.—The main orebody of the Tanner mine has been intersected 300 ft. below old workings by the 1300-ft. tunnel started two years ago. At point of discovery the vein is 3 ft. wide, compared with 10 inches in the old lateral. Operated by the East Belt Development Co., the Tanner is equipped with a seven-stamp mill and mine plant. The working force is to be immediately increased and drifts extended along the orebody. C. W. Canfield is manager.

IDAHO

Coeur d'Alene.—Official announcement was made October 9 by district miners' union No. 14, International Union of Mine, Mill and Smelter Workers, that the strike in the Coeur d'Alene, which has been in effect since July 15 last, was at an end, in the following brief announcement: "Notice to all miners and mill men: The strike has been declared off at all mines and mills in the Coeur d'Alene district." It is predicted that within the next week or ten days at least 1000 miners will come into the district seeking work in the mines. Hundreds of miners who left the district immediately after the strike was called are expected to return. Wages paid in the Coeur d'Alene are high and working conditions, in spite of charges to the contrary, are good.

Lookout.—The orebody on the property of the Bullion Mining Co. has been followed by a drift for 50 ft. on the deep tunnel level.

Wallace.—The orebody discovered recently on the 500-ft. level of the Consolidated Interstate-Callahan mine is expected ultimately to double the present ore-reserves. The zinc content is about 30% and is equaled in value by the lead and silver content, according to an earlier report.

MONTANA

Neihart.—The Cascade mill is treating 150 tons per day by concentration and flotation, with satisfactory results. Frank R. Wicks, who has been experimenting on the treatment problems at the Cascade mill, states that it is planned to increase the capacity of the mill to 500 tons per day.

NEVADA

Battle Mountain.—Officials of the Copper Canyon Mining Co., owning properties at Copper Basin, about seven miles from Battle Mountain, have been advised that Governor Boyle and Messrs. Cole and Lord, Labor Commissioner and Federal Mediator respectively, will endeavor to settle the strike of miners which has tied up operations at Copper Basin for several weeks. The men were granted an advance of 50 cents per day, but went on strike when board was raised 25 cents daily.

Eureka. The old Richmond-Eureka company, whose

mines have been shut-down for several years, has been sold to Eastern men. The price is stated to be $9,500,000. The mines were first opened in 1869, and yielded $72,000,000 before they were shut-down owing to unfavorable freight rates.

Goldfield.—Reorganized Crackerjack Co. has arranged with the Florence Goldfield Co. to take over the lease now operated by the Florence Divide Co. on January 1, 1920. The lease is reported to be shipping $20,000 to $40,000 weekly and is working ground above the 400-ft. level. Control of the lease by the Florence Divide Co. expires December 31 and an extension was refused following a misunderstanding. Driving on the east vein has begun from the 320-ft. level of the Crackerjack, and cross-cutting continues from the 440-ft. level to open the Crackerjack vein.

Loring.—A small vein, carrying good silver and copper ore, is being developed on the Ethel group, one and one-half miles south of the Nevada Honey Bee. Three additional miners have been put on surface prospecting at the Nevada Honey Bee, while Tom Ward is opening up the find he made last week. The free gold showing and the pannings are encouraging. The Benedetti tunnel is in 307 ft. and the Malley shaft is down 160 feet.

Seven Troughs.—The mill of the Seven Troughs Coalition Co. has been started on ore from the dumps of the Mazuma Hills mine, which is being operated under a five-year lease by Charles Spencer, of San Francisco.

Tonopah.—All Tonopah mills have resumed operations save the Tonopah Extension. Most of the plants are running short-handed, but working crews are being steadily increased. The West End is receiving a large tonnage from lessees on the Montana, in addition to its own output. The MacNamara plant is running on ore from the Tonopah Divide, Tonopah Hasbrouck, and Divide Extension.

WASHINGTON

Stevens County.—The O-Lo-Lim Co. is installing larger machinery for the operation of its mine near the Detillion bridge on the former Spokane Indian reservation. James Keeth, manager, is putting in a large pump and air-drill compressor, with sufficient engine power to operate them. The mine is near the North Star state highway projected from Davenport to Meyers Falls, which is partly built and will be completed next year.

BRITISH COLUMBIA

Trail.—The Consolidated Mining & Smelting Co. received 4073 tons of ore in the first seven days of October. The receipts in detail follow:

Mine	Tons
Bluebell, Riondel	183
Black Bear, Rossland	231
Centre Star, Rossland	1400
Consolidated Mines, Clines	28
Highland, Cenar Creek	105
Iron Mask, Kamloops	42
Josie, Rossland	502
Loon Lake, Loon Lake	32
Lone Pine-Surprise, Republic	114
Mandy, The Pas	468
Monarch, Field	78
North Star, Kimberley	404
Ottawa, Slocan City	50
Paradise, Athalmer	44
Quilp, Republic	148
Ruth, Cedar Creek	100
San Poil, Republic	57
Sullivan (zinc), Kimberley	62
Velvet, Velvet	25
Total	4073

Personal

The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

Thomas M. Bains, Jr., is at Mariposa, California.

Jafet Lindeberg has returned from Nome to Seattle.

R. L. Chase is at Grand Valley, Colorado, on oil-shale work.

Charles C. Brackin, of Cleveland, is now resident in San Francisco.

Edward H. Benjamin was married to Mrs. Lucile Joullin, on October 17.

C. W. Purington has returned from Vladivostok to London by way of the Suez Canal.

Thomas A. Wetzel is taking charge of milling operations near Cosala, in Sinaloa, Mexico.

A. F. Keene, of New York, passed through San Francisco on his return from Searles Lake.

Sidney J. Jennings has been inspecting the Carson Hill mines in Calaveras county, California.

D. H. Ferry is in charge of the Yukon Gold company's dredging operations at Murray, Idaho.

Lyon Smith has become superintendent for the York Ferro-Alloys Co., at York, Pennsylvania.

B. F. Grant is in central Sinaloa on oil-flotation work for the Southwest Engineering Co. of Los Angeles.

C. M. Eye has returned from the Philippine Islands and expects to remain in Southern California for a while.

Austin H. Merrill, president and general manager of the Merrill Silver Lead Co., Goldfield, Nevada, is in New York.

A. M. McDermott, of Los Angeles, has become general manager for the El Fuerte Mining & Smelting Co. in Sinaloa, Mexico.

W. W. Lytzen, formerly geologist to the Interstate-Callahan Co., is now manager for the Big Ledge Copper Co., at Huron, Arizona.

Pepperberg, Reeves & Meredith have moved their offices from Mineral Wells, Texas, to Great Southern Life Bdg., Dallas, Texas.

Charles W. Newton, superintendent of the Con. Interstate-Callahan mine, in the Coeur d'Alene, is in a hospital at Rochester, Minnesota.

H. De Witt Smith, superintendent of mines for the United Verde Copper Co., has returned to Jerome, after visiting the Coeur d'Alene region, in Idaho.

Thomas A. Janney, superintendent of the Arthur plant of the Utah Copper Co., was married on October 11 to Miss Margaret Collins of Salt Lake City.

S. J. Speak, of the firm of Hooper, Speak & Co., London, has been visiting the electrolytic zinc plants in California, and is now on his way to Trail, B. C.

H. C. Bayldon, manager of the Atbasar and Spassky mines, is on his way hither from Shanghai, having been driven out of Siberia by the Bolshevists.

Morton Webber has been engaged in examination work at Globe, Arizona. He is now at the Empire copper mine, at Mackay, Idaho, in his capacity of consulting engineer.

Roy A. Sulliger, formerly mill superintendent at Minas del Tajo, Rosario, Sinaloa, is now general superintendent for the Estaca Mining Co., Contra Estaca, Sinaloa, Mexico.

G. B. Lyman, of the Copper Queen geological office, has started a class in practical geology, in connection with the educational classes offered by the company to its employees.

Carl Scholz, of Chicago, has been elected vice-president and general manager of the Raleigh-Wyoming Coal Co., a West Virginia corporation with headquarters at Charlestown. Mr. Scholz was chairman of the executive committee in charge of the Chicago meeting of the A. I. M. & M. E.

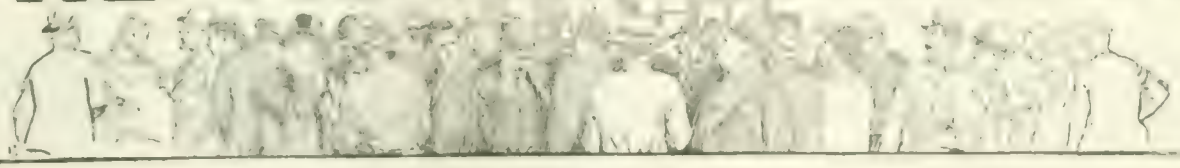
R. H. MacMasters Co., recently organized to conduct a general [illegible] business, has opened offices at 69 West [illegible]. R. H. MacMasters and **Ray D. Harris** are general partners in the business, and **Walter Harvey Weed** is a [illegible] partner. Mr. Weed is a member of the Consolidated Mining Exchange of New York.

R. T. Walker, [illegible] the past two years superintendent for the Virginia Louise Mining Co., arrived in Salt Lake City on October 15 to accept the position of assistant manager of the smelting department of the United States Smelting, Refining & Mining Co. This position was formerly held by **W. Allen Howard**, who was recently promoted to manager of the smelting department.

Obituary

Henry A. J. Wilkens was born at Baltimore, Maryland, on December 18, 1867, the son of Henry and Therese Wilkens. He received his early education at the Friends School in that city and at the age of 15 entered Lehigh University. There he took the scientific course, graduating in 1887, one of the youngest men in his class, with the degree of Bachelor of Science. He took a year's post-graduate work at Lehigh, receiving in 1888 the degree of Mining Engineer. In September, 1888, Wilkens matriculated at the Royal Mining Academy, at Freiberg, as a special student. He remained at Freiberg studying under Ledebur, Richter, and other famous German professors for two years and spending the vacations in taking practical courses at mines and smelters throughout Germany. On completion of the course he was given the usual certificate stating that the had completed his studies satisfactorily. In the fall of 1889 he returned to the United States and after a short period in the employ of the Empire Zinc Co. at Joplin was engaged by St. Louis mining interests to take charge of a small mine that they were prospecting and developing in the mountains east of San Diego, California. In the summer of 1890 he returned to the East and took the position of chemist for the Lehigh Zinc & Iron Co. at South Bethlehem, Pennsylvania. This was the beginning of a friendship and business association with August Heckscher and John Price Wetherill that continued for many years. Mr. Heckscher, in speaking of his work at that time, said that Wilkens was so quick with his analyses that for some time they suspected him of guessing at results, but that the most careful checks showed that he was always correct in his determinations. In 1891, still in the employ of the Lehigh Zinc & Iron Co., he was sent to the Franklin mine as Mine Engineer and Surveyor, and remained there throughout the time of the sinking of the Parker shaft. In the winter of 1894 and 1895, with the late H. B. C. Nitze, he entered the employ of the Geological Survey of North Carolina, and under the direction of Dr. Holmes, then State Geologist, made a complete survey of the gold deposits of the Southern Appalachian range from North Carolina to upper central Alabama. As a result of this work he and Nitze collaborated in writing two articles, one entitled 'Gold Mining in North Carolina and Adjoining South Appalachian Regions,' which was published in the North Carolina Geological Survey Bulletin No. 10, and the 'Present Condition of Gold Mining in the South Appalachian States,' which was published in Volume XXV of the Transactions of the American Institute of Mining Engineers. About this time, in collaboration with Nitze, he also wrote an article on the 'Magnetic Separation of Non-Magnetic Material,' which was published in Volume XXVI of the Transactions of the Institute. In the latter part of 1895 he entered the employ of the Wetherill Concentrating Co. at South Bethlehem and for the following two years he was engaged in work connected with the development and marketing of the Wetherill magnetic separator. In the winter of 1897 he went to Europe as a representative for that company, and, after long and difficult negotiations, sold the world's rights to the Wetherill patents to interests connected with the Metallurgische Gesellschaft, at Frankfort, reserving, however, the rights to use the process in treating the ores of the New Jersey Zinc Co. and its subsidiaries. Returning from Europe in 1897, Wilkens entered the employ of the New Jersey Zinc Co. His first duties consisted of general supervision over the operations of the Empire Zinc Co., a subsidiary of the New Jersey Zinc Co., in Missouri, and he was also largely connected with the development of the Schroeder contact process for the manufacture of high-grade sulphuric acid. By means of this process the first acid of this kind was manufactured in the United States. In 1900 the Empire Zinc Co. of Colorado was formed and an office was established at Denver. The operations of this company also came under Wilkens' supervision as well as the building of the mill at Canon City in 1901. During this and following years Wilkens was in general charge of all of the western operations of the New Jersey Zinc Co., the Kansas gas smelters, and various properties in the South-West and in Mexico. He examined and reported on many mining properties, among which were La Burfa and La Penescosa in Mexico, the Wythe mine in Virginia, and the Bertha. On March 1, 1908, he resigned his position with the New Jersey Zinc Co. From then until the latter part of 1911 he practised his profession as consulting mining engineer and during this time made an extensive trip through the West Coast countries of South America, examining many mines and prospects. In December of 1911 he became president of the Mines Management Co. During the next few years, through his connection with that company, he was instrumental in the rehabilitation of several of the old iron mines of New Jersey and Pennsylvania, notably the Mt. Hope and Washington mines of the Empire Steel & Iron Co. On January 1, 1916, he resigned as president of the Mines Management Co., and with Walter B. Devereux, Jr., formed the consulting mining engineering firm of Wilkens & Devereux, of which he was the senior partner at the time of his death. On August 1, 1918, he married Gertrude Wetherill, the daughter of the late William C. Wetherill, at Denver. For the past three years Wilkens had been far from well and during that time was forced to undergo three major operations within a relatively short period. He never fully recovered from the shock and strain of these operations, which undoubtedly were responsible for the sudden weakening of the heart that culminated fatally at Pueblo, Colorado, on the morning of September 13. Wilkens was a member of the Mining and Metallurgical Society of America and the American Institute of Mining and Metallurgical Engineers. He always refused to become a slave to business and stoutly maintained that work was the least important thing in a man's life. While able to concentrate his keen analytical mind, to the exclusion of everything else, on business matters, he also possessed the happy faculty of being able to forget business completely in vacation time. A crack shot and expert fisherman, his happiest days were those spent with his rod or gun with some chosen companion. The size of his catch or the number of birds mattered little to him: what he enjoyed was the outdoor life, and when shooting, watching and studying the working of his dogs. He was a close observer, student, and lover of nature, and possessed an exhaustive knowledge of flora and fauna. His desire for companionship was so great that he always wished to be with friends and was never really happy when alone. His love of children was remarkable and they all loved him. During the last years of his life he took intense interest in a Fresh Air Home for little girls and helped it greatly in financial and other ways. Of his sterling character, his kindliness, his charitableness and loveableness, the many devoted friends he leaves behind him are the best proof.—W. B. Devereux, Jr.

THE METAL MARKET



METAL PRICES

See Eastern Markets, October 21

Aluminum, ingot, per lb.	.60
Antimony, spot, per lb.	.9 ..
Copper, electrolytic, spot, per pound	.00
Lead, spot, per lb.	.6 ..
Platinum, per oz.	$140
Platinum, 10% iridium, per oz.	$150
Quicksilver, per flask of 75 lb.	$80
Spelter, spot, per pound	9.50
Zinc dust, per pound	11.00 .. 15.00

EASTERN METAL MARKET

(By wire from New York)

October 21.—Copper is quiet and firm. Lead is dull and higher. Zinc is more active and stronger.

SILVER

Bar silver offered for delivery in London, in cents per ounce of silver 999 fine. From April 23, 1918, the United States Government paid $1 per ounce for all silver purchased (New York basis). A maximum of $1.01½ on August 15, 1918, and was continued to Jan. 31, 1919, at which time the monthly premium under the Act is purchased prices advancing one cent per week. On May 5, 1919, all restrictions on the metal were removed, resulting in a free market. During the protected period the British government fixed the maximum price five times, the last being on May 1, 1919, on account of the low rate of sterling exchange. See quotations on May 10. The coinage cost of silver dollars (900 fine, 1,600 grains) is 16.05 pence per ounce (925 fine), calculated at the Legal rate of exchange.

Date	New York cents	London pence	Date	Average week ending Cents	Pence
Oct. 15	117.75	63.75	Sept. 9	111.99	60.96
16	118.25	63.75	16	114.37	61.14
17	118.12	63.75	23	114.10	62.04
18	117.87	63.75	30	115.70	63.14
19 Sunday			Oct. 7	119.56	63.71
20	117.62	63.75	14	117.44	62.83
21	118.62	64.62	14	117.95	63.98

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	75.14	88.72	101.12	July	78.07	99.62	100.36
Feb.	77.54	88.39	101.12	Aug.	85.40	100.31	111.35
Mch.	74.13	88.11	101.12	Sept.	100.78	101.12	113.92
Apr.	72.51	91.45	101.12	Oct.	87.48	101.12	.
May	74.01	99.50	101.23	Nov.	85.97	101.12	. .
June	76.44	99.50	110.50	Dec.	85.97	101.12	....

COPPER

Prices of electrolytic in New York in cents per pound

Date		Average week ending	
Oct. 15	22.12	Sept. 9	22.37
16	22.00	16	22.29
17	.21.87	23	22.10
18	.21.87	30	.21.58
19 Sunday		Oct. 7	.21.35
20	..21.75	14	.21.72
21	..21.75	21	.21.87

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	29.53	23.50	20.43	July	.29.67	26.00	20.82
Feb.	34.67	23.50	17.34	Aug.	.27.17	26.00	22.51
Mch.	36.00	23.50	15.05	Sept.	25.11	26.00	22.10
Apr.	34.16	23.50	15.23	Oct.	23.50	26.00	....
May	31.69	23.50	15.91	Nov.	.23.50	26.00	....
June	32.57	23.50	17.53	Dec.	.23.50	26.00	....

LEAD

Lead is quoted in cents per pound, New York delivery

Date		Average week ending	
Oct. 15	6.25	Sept. 9	5.83
16	6.25	16	5.97
17	6.50	23	6.20
18	6.50	30	6.07
19 Sunday		Oct. 7	6.16
20	.. 6.50	14	6.25
21	.. 6.50	21	6.43

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	7.64	6.85	5.60	July	10.93	8.03	5.53
Feb.	9.10	7.07	5.13	Aug.	10.75	8.05	5.78
Mch.	10.07	7.56	5.24	Sept.	9.07	8.05	6.02
Apr.	9.38	6.99	5.05	Oct.	8.07	8.05	....
May	10.29	6.88	5.04	Nov.	8.38	8.05	....
June	11.74	7.59	5.32	Dec.	6.49	6.90	....

TIN

Prices in New York in cents per pound:

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	44.10	85.13	71.50	July	62.60	93.00	70.11
Feb.	51.47	85.00	72.44	Aug.	62.53	91.33	62.20
Mch.	54.27	85.00	72.50	Sept.	61.54	80.40	55.79
Apr.	55.63	88.53	72.50	Oct.	62.24	78.82	....
May	63.21	100.01	72.50	Nov.	74.18	73.67	....
June	61.93	91.00	71.83	Dec.	85.00	71.52	....

ZINC

Zinc is quoted in cents per pound, East St. Louis basis, New York delivery in carload lots.

Date		Average week ending	
Oct. 15	7.75	Sept. 9	7.70
16	7.80	16	7.80
17	7.90	23	7.80
18	7.95	30	7.88
19 Sunday		Oct. 7	7.96
20	.. 7.95	14	7.72
21	.. 8.00	21	7.80

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	9.75	7.78	7.11	July	8.98	8.72	7.8
Feb.	10.45	7.92	6.71	Aug.	8.58	8.78	7.81
Mch.	10.78	7.87	6.83	Sept.	8.41	9.58	....
Apr.	10.39	7.04	6.49	Oct.	8.32	9.11	....
May	9.41	7.92	6.43	Nov.	7.76	8.75	....
June	9.63	7.92	6.91	Dec.	7.84	8.19	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. Prices, in dollars per flask of 75 pounds:

Date		Date	
Sept. 23	105.00	Oct. 7	95.00
30	105.00	14	85.00
		21	80.00

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	81.00	128.06	103.75	July	102.00	120.00	100.00
Feb.	126.25	118.00	90.00	Aug.	115.00	120.00	103.00
Mch.	113.75	112.00	72.80	Sept.	112.00	120.00	102.60
Apr.	114.50	115.00	73.12	Oct.	102.00	120.00	.
May	104.00	110.00	84.80	Nov.	102.50	120.00	. .
June	85.50	112.00	94.40	Dec.	117.42	115.00	....

MONEY AND EXCHANGE

The foreign exchanges seem for the moment to have struck a dead centre, with only mild fluctuations. The situation presents the elements for an interesting debate between opposite theories as to how the balance of effect will result between pressure of export bills and such factors as make for alleviation, including preparations already made, tourists' needs and the strong possibility that demand for our exports may continue to fall off. The one decisive question probably is the extent to which the latter influence will operate at a season when the outward movement of our raw material is normally greatest.

The action of J. P. Morgan & Co. in raising the rate on British treasury bills, issued each week, from 5½% to 6% is an indication that money is expected to maintain the present high level for some time. It has been the policy to fix the rate in keeping with the money market. The 5½% rate has been carried for several months. It is understood that not more than $100,000,000 of bills has ever been outstanding, and that the present amount outstanding is between $80,000,000 and $90,000,000. It is a sort of revolving loan, new bills being offered as old ones run off. In itself this raising of rates is of no great consequence, but, taken in conjunction with the course of the money market, it becomes noteworthy, especially following the more comfortable outlook in money in August and early September.

The last few weeks the money market has assumed a different aspect, caused by the more active stock market coming at the time of crop movement and usual autumn demands for trade. There appears to be no dearth of money for commercial purposes. Some time ago the rate for commercial paper was lowered to 5% for the best names, and business is still done at that rate. For time money the rate is still 6%. It is only on call loans that banks appear to be getting high rates. The reason advanced is that spare funds for loaning are obtained at expense of re-discounting at reserve banks. The banks have built up a large loan account, to meet the larger reserve on which they have had to have recourse to re-discounting. They cannot afford to put out a plentiful supply of cheap call money when committed for a large line of re-discounts. As soon as the banks have reduced re-discounts, the banks may be disposed to put out more money on call. Bankers, however, say this is impossible just now, with the insistent demand for accommodation.

Louis Grumbach, of Speyer & Co., just returned from 10 weeks in Europe, says it will be three years before Germany can again begin to figure in the world's export markets. American assistance is needed. "At present as high as 800 marks per ton ($200 on normal parity) are paid for imported American coal," he said. England and France are making strong efforts to get the German trade, a message from the English Board of Trade stating that "it is no part of the policy of His Majesty's government to discourage British traders from competing in German trade." The French government encourages its merchants to do likewise, as exchange conditions favor the purchase of German in preference to American goods. Mr. Grumbach said the present republican form of government will surely be retained in power unless living conditions deteriorate materially during the coming winter.

Quotations on October 21 are as follows:

Sterling:	Cable	4.19
	Demand	4.18
Francs:	Cable	8.57
	Demand	8.58
Lire	Demand	9.85
Marks		3.80

Eastern Metal Market

New York, October 15.

The markets are a little more active, and all of them are firm to higher as to prices.

With the absorption of practically all the outside lots the copper market is higher and firmer, but demand is not heavy.

The general tin market is quiet. There has been fairly heavy re-selling of spot and nearby tin by consumers.

The outside lead market is again on a par with the Trust prices, but buying is not heavy.

The zinc market is steady and firm, but buying is not in large amounts, sellers and buyers marking time until the steel strike ends.

There is no change of consequence in the antimony market.

IRON AND STEEL

It is expected that one effect of the steel strike, which is slowly crumbling, will be that demand will exceed supply and that pressure will be necessary to keep prices from advancing. There is some anxiety as to the effect on the present situation of the Industrial Conference at Washington. Thus far the trend from that source has been to encourage rather than dampen the ardor of the strike leaders. The leading plants of the Carnegie Steel Co. in the Pittsburgh district are operating at about 100%, while others that were shut-down when the strike started are still dead. Buying lately has centred in pig-iron. Heavy export demand for basic iron is now estimated at 75,000 tons, most of it from Japan.

COPPER

A considerable amount of buying appeared about the middle of last week, which has resulted in an evident absorption of most of the outside lots of copper and a decided strengthening of prices. Electrolytic copper, which could be purchased a week ago from outside sources at 21.25 to 21.50c. per pound, New York, cannot now be obtained for less than 22.12½c. and perhaps more for October or early delivery. We quote this as the market for electrolytic with Lake copper at about 22.50 to 23c. for the same position. The large producers continue to adhere to 23.50c. for last quarter, but they may revise this in the near future. The buying referred to last week is said to have started with certain purchasers for foreign account who arranged to have the ingots converted into wire and other products before exportation. The market is stronger than in several weeks and all the outside lots have been either absorbed or withdrawn. Labor troubles are still holding this and other markets in restraint. Total sales last week have been estimated to have amounted to 25,000,000 pounds.

LEAD

The market has been quiet but firm. The outside lots have been nearly, if not all, absorbed and prices are not up to those of the leading interest at 6.25c., New York, or 6c., St. Louis. It is not possible to buy lead from all sellers because they have not got it to sell, due perhaps to a lack of output as well as a well sold-up condition in some cases. Any large demand that might appear now would probably cause a stiff rise in the market. As it is, demand is fair and the market is quiet. Reports are to the effect that in some cases the St. Louis market is higher than 6c. or up to 6.05c. to 6.10c

ZINC

In the last week demand has been only moderate, but [illegible] higher. Prime Western for early delivery is quoted at 7.40c., St. Louis, or 7.75c., New York, with November and December delivery about five points higher, respectively. Sellers are not pressing the market and are firm in their ideas of value. Neither are consumers eager to purchase. Dealers have been fair buyers. The effect of the steel strike is still strong but its actual termination will be an incentive to the market, it is believed. There is very little export business.

TIN

The market has been quiet the past week. The main feature has been the re-selling of prompt and nearby delivery metal by large consumers, who because of the steel strike have no immediate use for it. As they sold, however, they at once entered the market for future delivery tin. Not only the steel strike but heavy arrivals of the metal was another cause for this rather unusual procedure. By this selling and buying of future metal, these consumers not only saved storage and interest charges, but turned a profit on their sales and saved a substantial margin on their new purchases. The tin involved on those sales was mostly Straits and amounted to 200 to 300 tons. Aside from this there has been very little doing. Arrivals of tin thus far in October have been 4105 tons, of which only 100 tons have come in at Pacific ports. There are 5220 tons reported afloat. The London market for spot Straits tin yesterday was £281 15s. per ton.

ANTIMONY

Conditions and prices are unchanged at 8.50 to 8.75c., New York, duty paid, for wholesale lots for early delivery.

ALUMINUM

No. 1 virgin metal, 98 to 99% pure, is obtainable in wholesale lots for early delivery at 32 to 33c., New York.

ORES

Tungsten: No business has been reported in the last week and, with present conditions in the steel industry and the tariff question unsettled, there is little prospect of any.

Molybdenum: Conditions are unchanged with demand very light and quotations nominal at about 75c. per pound of MoS_2 in regular concentrates.

Manganese: There have been no important developments in the market. Quotations are nominal at 50c. per unit.

Manganese-Iron Alloys: The ferro-manganese market is quiet with British producers quoting from $100 to $110 per ton, seaboard, and American producers about $110, delivered. About 9000 tons of spiegeleisen has been sold for export at around $33 per ton or less. The nominal price for domestic delivery is $35, furnace.

The figures of metal stocks held by the British government on October 1 are significant. Copper holdings of 51,000,000 lb. were almost 20% less than on the first of the previous month, and in all probability actual salable metal was much less, for a large proportion of the apparent copper surplus represents metal sold but not delivered. There is no question but England's surplus of copper is on the decline. British buyers must soon begin to cover. That they have already begun to do so is evidenced by the recent sale of a large tonnage of electrolytic for export at 22c. per pound, New York docks. The buyers were Englishmen who bought for immediate consumption. In the face of an adverse exchange situation, demand for export copper has been showing a marked and unexpected improvement during the past few weeks.

IN regard to the examinations of claims for compensation under the War Minerals Relief Act, we understand that the Commission is doing all it can to expedite matters. So far 400 claims out of 1200 have been decided. Precedence is given partly in the order of filing and partly in recognition of the need of the claimant, in accord with the information available.

EUROPE'S after-war necessities are indicated by the enormous expansion of our trade with the neutral countries and Belgium. During the first eight months of this year we have sold merchandise valued at 807 million dollars to them, or five times the amount recorded for the corresponding period of 1914. Belgium has received materials of food and reconstruction, partly financed by acceptances sold at New York, valued at $260,000,000, as against a trade of $40,000,000 before the War.

SENATOR HENDERSON'S resolution for dispensing with assessment work on mineral claims has not yet been reported from committee, and, we regret to say, there is considerable opposition to its passage without amendment by the Senate. We referred to this important matter in our 'Mining Summary' last week, explaining that it is proposed to limit the exemption from assessment work to five claims. This means that any individual or corporation claiming exemption upon five claims in which he or it holds an interest, no matter how small, is barred from claiming similar exemption from assessment work on any other claims that he or it may own in full or in part.

UNDER 'Discussion' we publish this week a number of interesting letters. The long one by Mr. R. B. Brinsmade will be read with interest by those who are awake to the importance of industrial economics, for Mr. Brinsmade has read carefully and observed thoughtfully. The steel strike and its origin are discussed by Mr. J. T. Owens, who finds something to commend and something to condemn in Judge Gary's attitude toward the strikers. Mr. T. Skewes Saunders, general manager for the Compania Las Dos Estrellas in the El Oro district, Mexico, supports Dr. Keith and Mr. Philip Argall in their attack on the Crowe patent for vacuum precipitation from cyanide solutions. He is supported by Mr. Arthur Feust, of New York. From Chile comes a letter on the strengthening of the roofs of reverberatory furnaces, from Mr. Samuel Fischer, who is smelter superintendent for the Compania de Minas de Cobre de Gatico.

WE are informed on the highest authority that King Albert of Belgium went away from San Francisco disappointed. He was received with respect and admiration, and oratory, during his recent visit to our city, but, much as he appreciated the speeches of the Mayor and the Governor, and the charm of their hospitality, he would have liked to make the acquaintance of those of higher rank, of whom he had read in our extremely well-informed daily press. For instance, he would have liked to meet "the fish king," Signor A. Paladini, and "the crab king," Signor Francisco Fusco, gentlemen apparently of the *haute noblesse* of this community. His disappointment did not end here, for he had heard of a Japanese gentleman called "the potato king" and he surmised that there must be a gentle Swede somewhere in the Sacramento valley answering to the title of 'the prince of asparagus'. Although we have no 'coal barons' in California, we have a whole peerage in oil and we have reason, like King Albert, to believe that the members of it are fit for the very best of regal society. Certainly we have at least one recognized "copper king" and other magnates, including "the czar of ragtime," who have been prominent in our newspapers recently. This illustrious group, representing our industrial aristocracy, would have interested the King greatly, for his experience in potentates has been limited to a few effete, and now discarded, rulers in Europe. Moreover, when King Albert read, in the 'Bulletin', about the "supermen" at the University of California he was more chagrined, we are informed, than he cared to say, that he should not have had an opportunity to see them. Five supermen have been discovered, so says the 'Bulletin', by Professor Kleeberger, who declares that "they surpass in physical perfection the great God Apollo and in masculine beauty the lovely Adonis." King Albert, not unnaturally, asked why his time had been wasted on the Yosemite or even in looking at the view from the Twin Peaks with Mayor Rolph in a plug hat in the immediate foreground.

MINING and industrial companies have made great strides during the last decade in the way of caring for their employees, but it has remained for the International Nickel Company of Canada to introduce a new departure, in the form of three annual scholarships for

a scientific four years' course leading to a degree in mining in the accredited Toronto, Queen's or McGill. The scholarships, which cover all expenses while attending the chosen university, are awarded on the result of competitive examinations among the minor apprentices and sons of employees in the mining and smelting division, which has its headquarters at Copper Cliff, Ontario. The first of the annual examinations has already been held, so that the successful candidates may take advantage of the coming academic year. It will be observed that after the fourth year the company will be paying the expenses of 12 students continuously. So far as we know, this gift is unique, but it is the sort of thing we should have expected from the International Nickel Company, which has already blazed an honorable trail for notably generous dealings with its employees and to increase their well-being. The effect of this gift upon the ambitions of its workmen will be great, but we venture to suggest that the effect upon the mining profession may be even greater. Many of the finest miners and smeltermen we have today were recruited from the ranks of what, for a better term, are often called 'practical' men. The 'school of hard knocks' develops character of a kind that is often denied those whose earlier years are surrounded by more luxury and less industry. Young men who have toiled hard for their living and who know the disadvantages of lack of training, upon winning a scholarship of this kind will take up their technical course with a full understanding of its benefits, an ability to correlate theory and practice, and an energy that will not let slip any opportunity for acquiring a thorough knowledge of their work. We would advise those that tread the softer path to 'watch their steps'; it is probable that in a few years these lusty young sons of the stope and the blast-furnace will be looming large in the mining profession.

The Industrial Conference

The failure of the National Conference is little short of a calamity, and Secretary Lane's plaintive letter to the President asking for a new one shows that the Administration at Washington recognizes the seriousness of the failure. The reasons for the miscarriage of a good purpose are fairly obvious. In the first place, no agenda or program had been prepared, so that there was nothing to steer the conference away from the rocks of bitter controversy on which it suffered shipwreck. Next, its personnel was ill chosen. It was a mistake to include Mr. Elbert H. Gary among the representatives of the public, or, indeed, to afford the facilities for a prompt altercation between him and Mr. Samuel Gompers. Moreover, although organized labor was well represented, the larger mass of unorganized labor—embracing two professions—was not represented at all. The Conference became little more than an arena for debating the chief issue involved in the steel strike, namely, 'the closed shop' and 'the open shop'. Judge Gary was utterly uncompromising, and many will sympathize with him in his attitude, but it is quite evident that his treatment of the controversy is likely to drive Mr. Gompers, as the wise leader of the reasonable and law-abiding elements of labor, into the arms of the radicals and anti-social group, represented by such men as Fitzpatrick and Foster, at the head of the steel strike, or Nolan and Bagley, who are at the head of the outlawed pressmen's union in New York. This is no time for antagonizing needlessly the truly American party in the ranks of labor as against the unruly alien party that is endeavoring to subvert our social structure. There is too much talk of "rights"; too much reactionary sentiment. All the "rights" that a citizen has are his by consent of the community as crystallized into law; with every "right" goes a corresponding responsibility to safeguard the welfare of the community. The vendetta between employer and employee—or capital and labor, if you please—is worse than a damnable nuisance, for it is waged in defiance of the obligation, owed alike by the employer and by the employee, to conduct his affairs so that the community does not suffer. Some of the employers are to blame; they are too plainly bent upon exploiting labor as if it were a mere commodity, not a human aggregate, but at this moment the public is bound to see that this feature of the struggle, while not negligible, is quite secondary to the outstanding fact that the radical faction is bent upon provoking revolution. Judge Gary is not intimidated by the prospect. As Mr. Lane says in his letter to the President, "Recklessness is in our blood, a great willingness to take risks that we have no right to take." Individuals or groups of individuals may take risks for themselves, but they are not warranted in risking the welfare of the nation in the course of their antagonism toward each other. Organized labor, after all, is not the whole show. Of the total labor in the United States, not one-sixth is organized; perhaps it were better if it were all organized, for then it would be less a class affair, because one kind of labor employs another and the class distinction would be impaired, as it ought to be. Judge Gary is an able man and the U. S. Steel Corporation is a splendid organization, but he and it are of minor importance as compared with the whole United States. The parties in conflict must adjust their difficulties within legal limits and without jeopardizing the welfare of the entire country. As against the breaking of the law, there must be no compromise, but in the adjustment, in a peaceable way, of the "rights" of this or that individual or group of individuals, there must be a compromise of conflicting interests, in order to protect the larger part of the population outside the quarrel. All our social conventions are the result of such compromise; only a savage fights for his rights regardless of those around him; the civilized man recognizes his responsibility toward society as a whole. The Conference ought to have set a good example, instead of furnishing another bad one. We hope that Mr. Lane's suggestion to call another conference, composed of representative public men, will be adopted and that some of our best men will apply themselves officially to the problem of adjusting these industrial disputes on an equitable basis.

The Leasing Bill

Good progress is being made with the Mineral Land Leasing Bill. It has been returned, with some forty amendments, by the Committee on Public Lands to the House of Representatives, which will now pass upon it, before returning it to the Senate. The Bill might be called the Oil-land Leasing Bill, for it concerns the oil-lands of California and Wyoming more particularly, being designed to quiet the long-drawn out controversy over the tracts withdrawn by the Government, partly as reserves of oil for the Navy. It has been claimed that 750 million barrels of oil have been held back in consequence of the withdrawal order issued by President Taft. In Wyoming the Bill affects 1,131,300 acres, mostly in the Salt Creek field. In California the leasing bill is not altogether acceptable, because many of the operators believe that they have rights more specific than a lease, but most of them will be glad to get rid of an expensive litigation and acquire better title than is probable under existing conditions. The Bill relates to "the mining of coal, phosphate, oil, gas, and sodium on public domain." It will affect the phosphate industry considerably, for the lands involved are said to contain some twenty million tons of phosphate. The efforts to promote the enactment of a leasing bill started soon after President Wilson's first term began, six years ago. Both the President and Secretary Lane have been credited with a desire to hasten the relief enactments for opening the lands under dispute, and it is possible that favorable legislation would have ensued much earlier if the Supreme Court had not decided against the oil-claimants in the Mid-West case in 1915. A bill was introduced in the last session of Congress and it seemed likely to pass when Senator La Follette talked it out. The present bill provides that the holders of productive wells on the naval reserves shall be given leases "with an area of land sufficient for the operation thereof" and that "the President may, at his discretion, lease the remainder of any such claim upon which wells have been drilled, and in the event of such leasing said claimant or his successor shall have a preferential right to lease." It is stipulated specifically that no claimant "who has been guilty of any fraud or who had knowledge or reasonable grounds to know of any fraud, or who has not acted honestly, and in good faith, shall be entitled to any of these benefits." This leaves plenty of scope for further litigation, for the honesty of the locations is the chief issue in many of the lawsuits now pending. If the holder of ground upon land covered by the withdrawal order of September 27, 1909, but not within any naval petroleum reserve, will relinquish his claim, and if he will pay to the Government "an amount equal to the value at the time of production of one-eighth of all the oil or gas already produced and saved from such land," then he will be entitled to a lease for a period of 20 years, "at a royalty of not less than 12½% nor more than 25% of all the oil or gas produced and saved." Other unappropriated oil-lands may be leased to the highest bidder in areas not exceeding 640 acres, such leases being conditioned upon the payment by the lessee of a bonus together with a royalty of 12½% per annum and a rental of $1 per acre per annum. We need not go into further details, because the Bill will be subjected to many changes before it is passed. When this is done, we shall publish the full text of the Act.

The Threatened Coal Strike

The President's pronunciamento, insisting that the order for a general strike in the bituminous coalfields be recalled by the United Mine Workers of America, will give keen satisfaction to every good citizen. This step was taken none too soon by the Chief Executive; it will serve to crystallize public opinion. The intention of a small number of men to "paralyze the industry of the country" in order to enforce their excessive demands for increased pay and shorter hours constituted "a grave moral and legal wrong against the Government and the people of the United States." The strikes already declared, and in force, have crippled the industries of this country at a time when every consideration, economic and humane, calls for increased productivity. It is evident to any intelligent observer of current events that at this moment there is being waged a conflict not so much between employers and employees in various areas of industrial turbulence as a contest between the law abiding labor leaders and the lawless ones, between the labor element that is honestly and properly endeavoring to better conditions of life and of employment and the anarchistic element that is trying to introduce the ideas of the soviet and of bolshevism into the United States. A concerted effort is being made not by genuine laboring men but by groups of reckless revolutionists, all over the country, to impose their anti-social notions upon American industry. The steel strike, the press-men's strike, the longshoremen's strike, the threatened coal strike, the threatened railroad strike—these are portentous not only because they synchronize, and therefore cause much damage and distress, but because they indicate an attempt to seize society by the throat and compel it to surrender to the illogical and unreasonable demands of an unruly and lawless mob, largely composed of aliens. The coal strike is "a fundamental attack, which is wrong both morally and legally, upon the rights of society and upon the welfare of the nation." So says the President; and it is high time he said it. The function of government is to govern. The public has suffered enough from the cat-and-dog fight between capital and labor in total disregard of the general welfare. This coal strike, declared for November 1, is illegal because it disregards an agreement on wages between the coal companies and the coal miners that was made with the sanction of the United States Fuel Administration, and that runs during the continuance of the War, but not beyond April 1, 1920. The war is not yet ended, for peace has not been declared: therefore the coal miners are still bound by their agreement, but, like other unions, the United Mine Workers are treating their contract as a scrap of paper. The

[illegible] is morally wrong because it is being started at a [illegible] when it will cause the maximum of suffering to the population, particularly to those least able to provide in advance for their domestic supply of fuel. Congress and the people will support the President and the Administration in this hour of national crisis. We can join, in the words of the resolution proposed by Senator Charles S. Thomas before the Senate, "in giving the national administration, and all others in authority, the assurance of our constant, continuous and unqualified support in the great emergency confronting us, and call upon them to vindicate the majesty and power of the Government in enforcing obedience to and respect for the Constitution and laws, and in fully protecting every citizen in the maintenance and exercise of his lawful rights and the observance of his lawful obligations."

The Press-Men's Strike in New York

In consequence of the "print" condition of the New York printing trade, our contemporary, the 'Engineering and Mining Journal', has been endeavoring to arrange for printing its issues in San Francisco. It is stated that 153 magazines and 300 trade papers and other periodical publications are affected by the strike of press-men, feeders, and compositors in New York. The deplorable conditions now obtaining are due to an internal fight among the unions, and not to anything done by the publishers. Two press-men employed by the Publishers Printing Company were expelled from a local union because they retained their membership in the international union, called the International Printing, Pressmen, and Assistants Union, with which the local union was affiliated. The word 'international' refers to Canada, not to Europe. The local union demanded that the company discharge the two international men; in other words, the local union, although affiliated with the international, was fighting it. Thus the publishers were between two fires. They decided to stand by the international union, which is the more responsible, whereupon the local unions declared a strike, in violation of their contracts with the publishers and in disregard of the orders of the international union, which has now outlawed them. New unions are being formed, within the jurisdiction of the international. The printers, regarding the demands of the local unions as irregular, have closed their establishments, so that fully 7000 men in the printing industry are out of work. Disciplinary control on the part of the international has failed in preventing members of the typographical union, or compositors, despite a vote opposing the strike, from taking a holiday, that is, quitting [illegible]. The result is that New York is already paying higher wages than other cities, and unfortunately the concentration of publishing businesses in New York has tended to aggravate the difficulties by causing a shortage of the special kind of labor required. A diversion of the printing business to other cities near-by has already begun and the present strike undoubtedly will lead to a wider distribution, for many cities are bidding for the patronage of the New York publishers, who will go far afield rather than expose themselves to another experience such as the one they are now undergoing. The zone postal-rates may be another factor in favor of printing papers and magazines of national scope nearer the centre of circulation; likewise the comparatively poor track facilities available in New York for the delivery of paper from the railroad-cars to the printing-plants. It seems certain therefore that important changes are impending. The public, we feel sure, will show their sympathy with the New York publishers by not standing too rigidly on their legal rights as subscribers, and we have no doubt that the advertisers likewise will take such steps as will minimize the loss entailed on the magazines and trade publications by circumstances beyond their control. They are the victims of labor anarchy, not of legitimate unionism.

General interest has been aroused by the method used by the 'Literary Digest' to obviate the difficulties arising from the printers' strike in New York, by photographing the typewritten copy and reproducing it by photo-engraving on zinc-surfaced blocks. In order to do this the manuscript has to be copied by expert typists on the best typewriting machines, so as to ensure perfect alignment. The typewritten sheets used are longer and wider than the column of the magazine in order to permit reduction; they are pasted upon large sheets of cardboard before being photographed; the process engraver then reproduces them by etching on zinc, the blocks being exactly the size required to fit a column. The time consumed between sending the finished copy from the editorial rooms and delivery of the zinc blocks to the printer averages nine hours. Before these operations are started, it is necessary that the original manuscript be carefully typewritten and corrected, for no corrections can be made in the later stages of the process except at excessive cost and loss of time. The experiment is interesting, but, of course, this method has been used before; indeed, it is not at all uncommon to photograph and engrave the pages of a book rather than re-set the type, and our readers will have seen tabulated statements of statistics that we have reproduced by this method, largely to avoid the chances of error incidental to setting a complicated series of figures in type in our own composing-room. The cost of the method used by the 'Literary Digest' is nearly twice that of ordinary type-setting and printing, and for that reason it has not been adopted in the business of publishing. The 'Literary Digest' has shown enterprise and has won a wide advertisement by its adoption of this means for circumventing the striking compositors of New York, but there is no reason for believing that the method will come into general use. The result is not satisfactory, apart from its costliness, because the typewritten words [illegible] as well defined as those set in type. Nobody would prefer to read the pages of a magazine such as the publishers of the 'Literary Digest' are now issuing in preference to the clean clear-cut typography resulting from the conventional processes; and the strikers, of course, are well aware of the fact.

Mr. Ingalls and Walkerian Economics

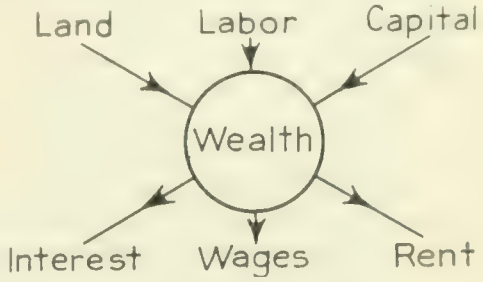
The Editor:

Sir—In his presidential address entitled 'The Economic Duties of the Engineer', delivered last January before the Mining and Metallurgical Society, Mr. Ingalls made the following statements: "One of the greatest of economic laws is that of the survival of the fittest, which exhibits itself in competition, and from that is derived the classic economic doctrine that labor is the residual claimant upon the produce of industry. After the shares of the State, the landlord, the capitalist, and the *entrepreneur* have been deducted, all the rest goes to labor, and here is what is mystifying to many, to wit, rent, interest, and profits are limited by competition, and of them the laborer can get neither the share of the landlord nor of the *entrepreneur* by any economic means, while, as for interest, the residual claimant . . . is better off when a high rate of interest is being paid than when a low rate is paid. . . . The inequality in the distribution of wealth is not between the capitalist and the laborer, but rather is it among the laborers themselves. . . . This is no preaching of capitalism as commonly understood, but is simply classic and proved economic doctrine."

As Mr. Ingalls in this address failed to give his authority for his "proved economic doctrine" I fancied him merely floundering beyond his depth in an unfamiliar subject and that his fallacies were so glaring that he would soon be set right by some wiser friend. But my hope was disappointed, for nearly a half year later he addresses the Canadian Mining Institute on 'Industrial Co-operation'[2] and voices the same fallacies as before. And though this time you sharply criticize his address in a short editorial[3], I believe the subject important enough to warrant some further remarks.

Before scrutinizing Mr. Ingalls' statistics, I beg leave to dissect his "classic economic doctrine" for if that be proved, as he claims, little can be argued against the truth of his resulting theory of industrial relations however repugnant the latter may be to our democratic sentiments. As his doctrine concerns the primary equation between the production and distribution of wealth it can be reduced to its simplest terms in the Trinitarian diagram in the next column.

This diagram signifies that the three essential factors of production—land, labor, and capital—unite to produce wealth, which thereafter is distributed among the three factors, labor receiving the wages, capital the interest, and land the rent. Taking these seven terms in their strict economic sense[4] we find that Mr. Ingalls mentions



two more productive factors—the *entrepreneur* and the State—and two more distributive items—profits and taxes. It is clear, however, that the *entrepreneur* is merely one class of mental laborer, while the State is a silent partner in all productive enterprises as it furnishes more or less of its land, its capital, and its labor to assist every one. Accordingly taxes may be classed in turn under the headings of wages, interest, or rent as they represent a payment made for the use of the labor, the capital, or the land of the State. Profits likewise cannot correctly be considered as a simple item of distribution, but should be classed as wages when due to the labor of the *entrepreneur*, as interest when due to the use of capital, and as rent when due to the natural surplus yield of land.

Though Mr. Ingalls at the beginning of his free quotation from General Walker[5] makes some correct deductions, as to rent and prices, from Ricardo's 'Law of Rent',[6] he completely misses its meaning when he remarks:

"It [rent] must go to the landlord unless it be confiscated by the State or ravished away by violence, and in

[1]'M. & S. P.', February 8, 1919, p. 190.

[2]'M. & S. P.', June 28, 1919, p. 877.

[3]'M. & S. P.', June 28, 1919, p. 869.

[4]J. E. Symes in Chap. I and II of his 'Political Economy' thus defines these terms: "Land includes such material gifts of nature as can be monopolized; labor includes all manual and mental human exertions used to produce wealth; capital includes such material products of labor as are devoted to the production of other objects of desire; wealth includes all the material products of human labor which arouse desire. Assuming free competitive conditions and wage in the share of wealth secured by laborers, interest is the share secured by capitalists, and rent is the share secured by the proprietors of natural objects and forces."

[5]'M. & S. P.', June 28, 1919, p. 877.

[6]Syme's 'Political Economy', p. 29, gives "The normal rent of any land is got by deducting the produce of land on the margin of cultivation from the produce of the land in question."

either of these events it will soon cease and no longer accrue for anybody."

But it is evident that it makes no economic differences at all to the tenant whether he pays his rent to a private person (landlord) or to the State, nor does he care whether his rent is called a 'voluntary offering' or a ravishment by violence, provided it has to be paid in either case. Ricardo's theory therefore implies nothing of Mr. Ingalls' assertion that rent will cease when collected by the State as landlord; and the practical facts also contradict Mr. Ingalls as is proved by the large annual sums received by many governments from the lease of their public lands.[7]

Mr. Ingalls' next assertion that "profits economically partake of the nature of rents" is just one-third of the truth, for I have already shown that 'profits' may be correctly classified under interest or wages quite as often as under rent. And how misleading a third-truth may be is demonstrated when he further remarks: "Just as there is a class of no-rent lands, so is there a class of no-profit employers, the need for whose produce determines the market-price. From the point of no-profit production, profits range upward through the degrees of moderate profits, liberal profits, grand profits, monumental profits, but these consist wholly of wealth created by the *entrepreneurs* themselves and no economic means would carry any portion of them permanently to wages. To be sure, they may be taken by the State as taxes, and by the State paid out in extravagant wages, but this destroys the economic balance and produces conditions whereof the result is that nobody makes any profit, industry languishes, and labor suffers."

Where 'profits' is synonymous with rent, the first sentence of this quotation is quite true. But the next sentence, where it is claimed that all larger rates of profit consist of wealth created wholly by the *entrepreneur*, is sheer nonsense, because such profits may as often be due to superior land or capital as to the ability of the directing labor. The diversion of large profits from the owners to the State by taxes, to be later paid out in high wages, would only make the industry languish when it discouraged the exercise of ability or the further investment of capital. Where the operation represented merely a transfer of rent from the landlord to laborers, it would have no such effect, for the former in his function as title-holder of raw natural resources is, economically, merely a parasite on production.

As a sort of a short postlude designed to clear up for himself—if not for his audience—this muddle of fact and fancy based on an incomplete conception of the term 'profits', Mr. Ingalls now proceeds to give some elementary instruction as to the difference between real and apparent profits, with an apt illustration drawn from his wide experience in zinc enterprises. This he does before [illegible], if accepted, to make the world safe for plutocracy— in the following astounding quotation from General Walker:

[illegible] annually as rent from the [illegible]

"Rents, interest, profits, and taxes being deducted from the produce of industry, all the rest goes to the laborers. 'So far as, by their energy in work, their economy in the use of materials, or their care in dealing with the finished product, the value of that product is increased, that increase goes to them by purely natural laws, provided competition be full and free. Every invention in mechanics, every discovery in the chemical arts, inures directly and immediately to their benefit, except so far as a limited monopoly may be created by law for the encouragement of invention and discovery.'"

By referring again to the Trinitarian diagram we can easily see that, as land, labor, and capital share among themselves the whole output of wealth, the share of one of the three productive factors in the output of any enterprise can only be increased at the expense of one or both of the other two. Also the share of wealth which one factor can obtain depends entirely on its relative strength in its struggle with the other two factors. As productive operations grow in size, it is evident that any one of the three factors which can be indefinitely increased in quantity is subject to competition, and consequently its share of wealth tends to be cut down to the minimum necessary for the factor's survival. As both labor and capital are of this competitive nature, wages tend constantly to approach the minimum of the lowest wage necessary to keep up a labor supply of the required quality, and interest tends to approach the minimum rate necessary to encourage the saving of sufficient capital. Land, on the contrary, being fixed in quantity, cannot be increased as production grows; it is therefore the only monopolistic factor of the three. Hence property in land is a legalized monopoly and a perpetual one, too, while property in patent rights—the only kind of monopoly Mr. Ingalls has been able to discover—is temporary. The final result of the competitive struggle between land, labor, and capital is that the monopolistic factor—land—takes the whole residue of wealth from any operation after labor and capital have been paid their living wages. Thus land and not labor is the residual legatee of industry, and to supplement this simple *a priori* proof I have no less an authority than the greatest British economist, John Stuart Mill, who says[8]: "The economic progress of a society formed by landowners, capitalists, and laborers tends to the progressive enrichment of the landowners."

In sciences like political economy, whose phenomena are so widely extended that a theory can seldom be proved on a laboratory scale, the selection of a special case, involving only the factors pertinent to the problem in question, is often both legitimate and sufficient. But for such an illustration to be scientific it must be in harmony with existing facts, and the example next quoted by Mr. Ingalls does not satisfy this criterion. It would be impossible for the same laborers to increase their output by 5% over-night; likewise if a different set of more productive laborers were substituted, as is proposed, it would normally imply only a more expensive training, and the 5% extra output which they secured as wages

[8] 'Political Economy', book on 'Land'.

would represent the interest on the capital cost of this training. The illustration shows that skilled labor can get more wages than unskilled labor, because it costs more to produce the former, but it quite fails to prove that labor is the residual legatee of industry.

As Ricardo's 'Law of Rent' expressed graphically in the Trinitarian diagram shows that private legal monopoly originates in unrestricted land ownership, it is highly disturbing to an organized plutocracy which fears its political effect on its fellow citizens. Yet there is no cause for alarm as long as the latter can be as successfully camouflaged as Mr. Ingalls has evidently been by General Walker, whose reactionary economic school includes many American college professors and such European writers as Say, Mangolt, Herman, Goschen, and Mallock. This school brazenly befogs the truth by declaring that "the rent of land is not a thing by itself but is the leading species of a larger genus;" it affirms that differential productive advantages are not peculiar to landowners but are also possessed by capital owners and laborers with unusual ability. On this basis, the wages of ability and the interest of capital are analogous to land rent, so all three can be lumped together, when desirable, and called 'profits'. Thus is confusion worse confounded and land monopoly so safely denatured, that the consequent erudite dissertations of the 'experts' in political economy become as pleasing to our modern plutocrats and their dupes as were ever the involved diagrams of Ptolemian astronomy to the medieval monks.

So much for Mr. Ingalls' theories—now for his statistics! Here, while he modestly disclaims any knowledge of the exact figures, he does not hesitate to found upon his surmises the most dogmatic and wildest generalizations as to prevailing economic conditions. In January he thinks labor gets 80% of the nation's income but in June he discovers Dr. Bowley's figure of 60% for Great Britain and, unabashed, remarks:

"Numerous studies of both Great Britain and the United States show that of the whole produce 60 to 80% goes to labor and that the remainder is but a relatively small return on the capital used. But we are able to show and to say a good deal more than that, to wit, that during the last hundred years of great industrial development the *major part of the benefit* has accrued to labor."

Laying aside for the moment the slight discrepancy of ten billion dollars—or $100 per capita—between the 60 and 80% figures for labor's share of income, let us consider the 'small return on the capital used' which elsewhere[9] Mr. Ingalls estimates to average 4% annually. Yet any such return affords no explanation whatever of everyday financial phenomena. Can it explain how our hundreds of 'self-made' millionaires have risen from poverty to a plethora of wealth within two or three decades? For a sum to double itself at 4% requires 18 years; and if a man saved $10,000 a year it would be 41 years before his fortune, accumulating at compound interest, would reach one million, much less the many millions which scores of our compatriots have accumulated by middle age. No! neither compound interest at 4% nor a high salary and a saving disposition can account for huge private fortunes; no more can Walkerian economics. Yet what is impossible for blatant empiricism is often easily achieved by science, and so it is here, for the Trinitarian diagram explains the problem quite simply.

Of the two productive property factors of the diagram, the one, *capital*, is competitive and its reward—interest—tends to a minimum, which meant a rate of 3½% annually in the London money market before the Great War; the other, *land*, is monopolistic and its reward—rent—has no upper limit except its surplus yield, or differential advantage, above that possessed by land at the margin of production. Moreover, since the value of property is computed by capitalizing its annual yield at the current rate of interest, the selling or market value of landed property has no relation whatever to the labor or capital expended in its development but is simply the sum obtained by capitalizing its rent. Therefore the owners of our richer lands constantly receive large sums as rent which represent no original investment of either labor or capital, and wherever they have obtained their land titles from the Government at little or no cost to themselves—as has been feasible in the case of our public lands—they have rapidly been enabled to get rich without working. Such rewards from the ownership of monopolistic property are called 'unearned increments' and they furnish the only means for validating 'watered' stocks. The temporary legal monopoly conveyed by the patent rights for invention also give rise to similar increments, but these privileges are plausibly supposed to—and really would if the law were perfected—merely grant a proper reward to inventors for their services to society. All other enterprises, beyond those based on land or patent-right ownership, are outside the law when they attempt to secure monopoly profits, and it is safe to say that none can long do so when not in close alliance with one or both of the two legal classes of monopoly.

In order to show how far the existing facts of industry differ from Mr. Ingalls' 4% 'statistics', I will cite a few examples of the enormous unearned gains accruing to certain lucky owners of land, taking up in turn the five varieties, namely, agricultural, timber, mineral, townsite, and public-utility, and considering only the value of the lands themselves apart from their improvements or betterments.

The value per acre of rich agricultural land reaches only moderate figures, but its total area is so large for the United States that both its aggregate value and the unearned increment this represents is enormous. As long as fertile accessible lands could be had for the asking from the Government, farms remained cheap; when this happy condition passed in the 'nineties the pressure of our increasing population caused a rapid rise in land value. This advance has been especially noticeable in the Middle West, where the small towns are filled with retired farmers living on their rents or on the income derived from the sale of their farms. Kansas and Nebraska

[9] 'M. & S. P.', February 8, 1919, p. 190.

lands that went begging at $10 to $20 per acre in 1890 now bring from $50 to $100, while Illinois lands, then considered dear at $50, now readily sell for $200 per acre. It is safe to predict that if our present land system continues, the best land will soon be selling at $400 to $500 per acre as in Belgium. In 1900 the total value of our farm lands was 13 billions, ten years later this had advanced to 28½ billions, or 118%, while the increase in area was proportionately small.[10]

In 1870 the country's forests were 75% publicly owned, in 1910 about 80% had become private property.[11] The richest forests on the globe are those of the Pacific North-West and those not given away to railroad promoters were mostly sold at $2.50 per acre under the Timber and Stone Act. Passed ostensibly as an aid to settlers, the net result of the latter act was a loss to the nation of 12,000,000 acres of forest, of which 80% has been transferred by the 'settlers' directly to speculators. Lands reasonably worth 240 millions at the date of sale were ceded for 30 millions or an instantaneous profit for the speculators of 700%. Our second-best forests are the Southern pine of the Gulf States, and these were sold by the Government at $1.25 in the three decades following the Civil War. These pine lands now sell at $50 per acre, equivalent to an increase of 4000% in 40 years.

Like our rich soils and wild forests of big trees, our superior mineral deposits are a gift of Nature to the nation; nevertheless they have been likewise given away, for little or nothing, to first-comers. Perhaps the most remarkable example of the resulting gain for industrial parasites occurs on the Mesabi range, which was, thirty years ago, a primeval forest selling for its timber at $1 per acre. In 1890 the first of the great bodies of rich iron ore—shallow, soft, and cheaply-mined—was discovered, and many such are now known to occur at intervals along a strip 100 miles long and ¼ to 2 miles wide. In most cases, the landlords here do no mining at all, for the leasing companies explore the ground gratis with diamond-drills, and then pay a royalty of 15 to 50 cents per ton on all the ore they extract. It is not uncommon for a 40-acre tract to yield 4,000,000 tons of ore on which the landlord collects a royalty of $1,000,000 or 25,000 times his original investment of $40, an increase of 2,500,000%. Of the profusely-watered stock of the U. S. Steel Corporation, amounting to nearly 1½ billions at par value, C. M. Schwab testified in 1901 that 700 millions represented the value of iron-ore properties. Of these 'properties', the bulk were undeveloped mineral lands on the Mesabi range.[12]

It is perhaps superfluous to dilate further on a subject so familiar to mining men, but for Mr. Ingalls' benefit I will quote a case of unearned increment here in Mexico. The well 'La Corona', of the Dutch Shell company in Panuco, produced 50,000 barrels of oil daily on which a moderate estimate of net operating profit would be $10,000. This amounted to over $3,000,000 per year, or a gross profit in one year of 8000% on the $37,500 cost of the well. These marvellous gushers often last several years, as instance the 'Casiano No. 7' of the Huasteca company which yielded, in the four years ended September 11, 1914, a total of 33,580,000 bbl. of oil and was then still spouting daily 20,000 bbl. of oil and 10,000,000 cu. ft. of gas.[13]

For townsite land, that of New York presents the most startling example of unearned increments. Bought in 1646 from the Indians for $24.60, the island of Manhattan was assessed for taxation in 1914 at some three billions, or $1240 per capita. As the corresponding assessment of improvement value was only 1½ billions, the townsite owners are evidently drawing double the income, from their paper titles, of what is received by the owners of all the capital which has been required to turn New York from a rocky barren island into the national metropolis. During 268 years the landlords have averaged an increase of $450,000 for each dollar paid the Indians, or an annual rate of 45,000,000%.[14]

Though most public utilities are now in a bad way, owing to rising expenses and an income limited by law, this was not always so, for many a reigning financial magnate started his career as an impecunious franchise-grabber. Vast unearned increments have accrued to concessionaires of steam and street railroads and of pipe and wire lines. In many cases, the normal gain of the franchise monopoly has been augmented by huge bonuses of land—or even of cash—bestowed on the promoters by a doting city, state, or nation. A well-known example is that of the Union Pacific railway whose four promoters were able to draw out, within 20 years, over 100 times their original investment of $125,000—a gain of 500% annually.[15]

The quoted examples, however surprising, are not war-profits—they all happened before 'The Day'—nor are they sporadic, but the signs of a widespread social cancer. Five-ninths of our income property is not economic capital at all but "capitalized privilege or capitalized predation," declared H. J. Davenport in 1910.[16] Disregarding Mr. Ingalls' estimates for our wealth and income—excessive even for the inflation of 1916—I shall assume 30 billions as a close approximation to our national income in 1913. Taking the British figure of 60% as the part paid to labor, and we have 18 billions to be divided among our total of 35 million wage-earners or an annual wage of $515 per person.[17] This is not far from the figure found by the U. S. Industrial Commission in 1915[18] and agrees closely with the exact figures I have at hand for the

[10] Abstracts of U. S. Census for 1900 and 1910.

[11] 'Report on Lumber Industry', Part I, 1911, U. S. Dept. of Commerce.

[12] 'The Truth About the Trusts', by John Moody.

[13] Trans. A. I. M. E., 'Oil Fields of Mexico', April 1915.

[14] 'Singletax Yearbook', by J. D. Miller.

[15] 'History of American Great Fortunes' by Gustavus Myers.

[16] 'Extent and Significance of Unearned Increment', Bull. Amer. Econ. Assn., 1910.

[17] 'Distribution of Wealth and Incomes in United States' by Willard King.

[18] 'The Manly Report of the U. S. Commission on Industrial Relations', U. S. Supt. of Documents, Washington, D. C.

Southern lumber industry. Mr. Ingalls' estimate of $1000, as the average wage for 1916, is absurdly high and quite lacks any valid foundation, for the wartime wages in steel-making offer no criterion of wage rates in general. After paying labor, there remained in 1913 an income for 'property' amounting to 12 billions, but at least half of this was not in any sense the interest of real capital but the unearned gain from land monopoly and similar forms of legal privilege or from illegal predation.

Evidently blind to these everyday facts, Mr. Ingalls blithely continues to dogmatize as follows:

"I have shown, I hope, that there cannot be anything essentially wrong in the existing system of the distribution of the produce of industry as between labor and capital. Labor cannot divide among itself any more than there is to divide, that is, the total of what is produced. That is self-evident [sic!]. It may attempt to seize the modest share of capital but, if it succeeds in doing so, that share dries up. If it confiscates capital itself it does not gain anything, for capital, without the directing minds to use it productively, ceases to be of advantage to anybody. . . . Why is it that while socialists are shouting from soap-boxes, inflaming the populace with irritant poisons, while doctrinaires [Prof. Davenport?] who hold professional chairs are issuing fallacies . . . we cannot drive into the heads of people that even as things are under the capitalistic system they get all they can . . . It is of profound importance to make the millions of workers see things correctly [through Walkerian glasses?] for they are blindly approaching a time when adverse economic conditions are going to drive them, and no socialistic ranting or paternalistic policies by the governments are going to help them . . . We have to contend with something quite similar and equally serious [as the fallacies of the workmen] in the minds of a large part of the employing class. This is the idea among thousands of them that they, too, do not get their due, that something is somehow stolen from them, in short, that they can get more than they produce. This idea finds expression in agrarian movements among the farmers to contest what they deem to be robbery by the millers and railways. It finds expression in the never-ending grievance of miners against the smelters. During the War the attitude of these people assumed the form of a rapacity that was only a little less extortionate than that of some classes of labor and which has a very ugly and dangerous aspect now."

After this sound berating from Mr. Ingalls' pedestal of economic and statistical wisdom, the working and employing classes ought to cease their clamors, but will they? Probably not, as long as 20% of our national income is going to industrial parasites! While they may be getting "all they can—as things are" perhaps the workers hope, with some show of reason, to alter those things a bit. The idea of the employers that "something is somehow stolen from them" seems to have rather a weighty foundation if we consider the mass of six billion metallic dollars.

In the past, fortunately for the monopolists, the most meddlesome labor leader could readily be cajoled into silence by giving his organization a share of the social loot, while any disgruntled competitive employer could usually be diverted from his personal grievances by giving him a chance to share the 'divey' by a flyer in grain or townlots or 'little steel'. Even when enough of the middle class resisted temptation and got together to launch a bark like the Populist party, it was easy to soon lure it to ruin on the rocks of practical politics. But the Great War seems to have cleared away these old obstacles to economic freedom, for we have now the British Labor party boldly proclaiming that "social wealth must be used for public purposes" and our own Non-Partisan League launching an effective campaign against the speculators in land and produce.[19]

While every land title is, theoretically, a special privilege, only a fraction of them will yield enough surplus, above the necessary rewards for the labor and capital utilized, to give them much of a social value. And even this select few can be depressed or deprived entirely of value if their way to market is controlled by some alien interest. This fact was known before the science of economics was even thought of, as many a ruined 'robber-baron' castle on the trade routes of Western Europe will testify. The profit of such practical wisdom is evidenced in our own day also by the career of such astute concerns as the Standard Oil,[20] the Beef Trust,[21] and (perhaps) the Smelter Trust.

Some years ago I encountered in Santo Domingo a miniature example of this penning up of producers, which was so ideally plain as to have satisfied the most exacting economic textbook writer. Ingress to the interior from Samana bay was blocked by a swamp some 20 miles wide over which the only causeway was occupied exclusively by the railway from the port of Sanchez eastward.[22] The Scotch owners of this line were canny enough to realize their unique position to a 'T' and, being unhampered by any public rate-making commission, they had fixed the freight rates for transporting goods to and from the rich lands of the Yuna valley, at just what the traffic would bear. As for passengers, they were charged about what a laborer could have earned in the time required to walk across the swamp on the ties of the causeway.

With much of what Mr. Ingalls suggests, in the balance of his long addresses, as to methods of increasing our output of wealth, I am in hearty accord, since on this non-political subject he dares to cast off his Walkerian blinders and speak freely from his well-trained mind and full experience. Yet near the end of his second speech he returns to the worship of plutocracy in the following words:

"What is, or ever was, the 'autocracy of capital'? . . . Substitute the 'authority of the directing minds' and we shall come nearer to the truth . . . Heavier tax-

[19] 'Non-Partizan Leader', published at Bismarck, North Dakota.

[20] 'History of Standard Oil Co.', by Ida M. Tarbell.

[21] 'Report on Packing Industry', U. S. Federal Trade Commission, Washington, D. C., 1918.

[22] 'Iron in Santo Domingo', 'M. & S. P.', September 14, 1918, p. 356.

aims of co-operation may have come to stay, but that in itself is going to be to the detriment of the men and women who contribute the labor that enters into production . . . The argument 'industrial democracy' is simply an expression of the discredited theory of Karl Marx, repudiated by socialists themselves, who recognize in the words of Mallock, that 'in any complex system of industry, such as that which prevails today, the efficiency of the workers as a whole is the average efficiencies of the many multiplied by the efficiencies of the few,' the Few being 'the natural monopolists of ability,' whose function is to issue orders, while that of the Many is to execute them with strict obedience."

Besides the sentence regarding the taxation of the rich—which is only true when the tax falls on their earned wealth—Mr. Ingalls here confuses two quite distinct questions: ownership and organization. Few of the 'directing minds' of industry own the works they manage and most of them are, theoretically, just mental laborers. Discipline is a matter of organization, not of ownership, and is as well maintained in the plants of stock companies, with absentee shareholders, as in those where the owner, himself, acts as foreman. 'Industrial democracy' is not synonymous with socialism[23] and seems to be the goal toward which modern social progress is moving. Just as the autocracy and oligarchy of the Middle Ages have gradually been superseded by democracy in the State, so will the irresponsible despots of the early factory epoch be slowly overcome by the competition of co-operation in economic life. Even now purely co-operative[24] concerns—where the workers and consumers own *all* the capital—have captured a large part of the grocery business of England, and will gradually extend their activities to other industries as the workmen attain a higher average standard of education.

The issue thus is not between capital and labor or between the talented Few and the stupid Many, as Mr. Ingalls would have us believe. Rather is it capital and labor versus private monopoly—the producers against the parasites.[25] Then how imprudent it is for an advocate of Walkerian sophistry to throw stones at the rival school of Marx! Handicapped as Marx was by a near-sighted mind and a lack of industrial experience, he yet labored for years conscientiously, in self-sacrificing penury, trying to prove by statistics Proudhon's absurd theory that "all property is robbery". While even Marx finally found the key to the economic mystery of property,[26] General Walker never did, for his last important work was 'Land and Its Rent'—an even feebler attempt than the book[27] of his English coreligionary to refute Henry George's masterpiece, 'Progress and Poverty'.

R. B. BRINSMADE.

Ixmiquilpan, Mexico, August 27.

[23] "Democracy versus Socialism" by Max Hirsch.

[24] "The American Cooperator" published at Lewiston, Maine.

[25] "Labor and Neighbor" by Edward Crosby.

[26] "Essay on Capital" by Karl H. of Capital.

[27] "Property and Progress" by A. Comyn.

The Value of Conference

The Editor:

Sir—In his remarks at the Chicago meeting of the Institute on "momentous social changes," Mr. Theodore W. Robinson said, as you report in your issue of October 11, that "Judge Gary recently declined to meet certain labor leaders because he rightfully did not feel that they were authorized to speak for a large number of employees, and because a conference with them would have been treated as a recognition of the 'closed shop' principle."

There is no one living who believes in the 'open shop' more firmly than I do; nevertheless, I cannot see any force in Judge Gary's argument. It is to me a typical example of the arbitrary action that has caused so many strikes. In the Colorado coal strike of 1913-'14 the same refusal was made by the operators. This went so far that at one time the representatives of the operators were in one room and the union leaders in an adjoining room, and yet no conference took place. We all know the savageness of the strike that followed. Very possibly the conference might not have stopped the strike, but there was a chance for arbitration that was refused.

Judge Gary was evidently mistaken on one point. He felt that the labor leaders did not speak for a large number of employees, but events showed that a very large number of employees came out on their orders.

The fear that a conference means a recognition of the 'closed shop' seems absurd, for it could have been stated plainly at the outset that the 'open shop' was the fixed principle of the company. Lloyd George's plan of having the labor leaders to luncheon seems a far better plan than to refuse a meeting. In such a conference there is always a chance of a better understanding. The labor leaders might be brought to see reason in the policy of the company and *vice versa*. For instance, the labor leaders object strenuously to the physical examination of employees, but a doctor in whom they have confidence might readily be able to prove to them that this examination is more in the interest of the employee and his fellows than in the interest of the company. An engineer with heart disease dying with his hand on the lever of a locomotive has caused a terrible wreck before now. And other physical defects might work serious injury to all concerned. Through physical examination defective men might be found work that would be least harmful to them and where they would not be a source of danger to their fellow-workmen.

I have consulted a number of my engineering friends on this question and we all feel that it was an error for Judge Gary to refuse to meet these labor leaders. At the same time we feel that Judge Gary deserves the highest admiration for standing firmly for the 'open shop,' for if this country ever comes entirely under the labor-unions we shall see a despotism as bad as the one that is now dying in Russia.

We do not feel that a conference with labor means

that a strike will not take place but we do feel that it is a chance of avoiding a strike that ought not to be neglected.

J. T. OWENS.

San Francisco, October 1.

[Judge Gary refused to meet the leaders of the strike because they were agitators, not the outside not workmen on the company's payroll. However, the point is well taken; disputants rarely meet in conference without a softening of the asperity between them, they learn to see something of each other's point of view, and that way lies conciliation.—EDITOR.]

The Vacuum Process

The Editor:

Sir—Mr. Crowe's original article as read at the Colorado meeting in September 1918, dealing with the effect of oxygen upon the precipitation of metals from cyanide solutions, is written in such a manner as to create at once the impression that the so-called Crowe vacuum process resulted from original thought, research, and development upon his part. He says, "I naturally reasoned that the removal of the dissolved air from solution would be the means of further benefiting precipitation, providing a vacuum could be practically applied to the solution, prior to, or during precipitation." This "natural reasoning" is logical and obvious in view of the writings of Messrs. Caldecott, Kirk Rose, Keith, and Swinburn upon this subject many years prior to Mr. Crowe's investigations.

In the short discussion that followed Crowe's paper, Professor Clevenger pointed out briefly, but plainly, that it has been known to many interested in cyanidation that gases in the solution were deleterious to precipitation and that the removal of such would be beneficial to subsequent operations, for he plainly stated, "Some of us have done practically the same thing some time ago." Later on (M. & S. P., of August 23) Dr. Keith quotes many instances of degassing pregnant cyanide solutions containing gold and silver prior to precipitation, and, to the impartial observer, makes out a strong case in support of the statement that the basic principle—as well as the process and its application to metallurgy—had been known and used at various places for several years prior to the appearance of the Crowe apparatus and, therefore, degassing a solution does not constitute a new discovery.

Much could be written in support of Dr. Keith's article and assumptions. Moreover the decidedly brief comment arising out of the original paper by Crowe could readily be interpreted as indicating that there was an atmosphere of uncertainty concerning the novelty of the discovery within the meaning of the patent laws of the United States, but these phases of the matter are relatively unimportant compared with the contribution of Philip Argall that appeared in the M. & S. P. for September 20. Presumably ere this letter reaches you several of a similar nature will have been received covering practically the same ground, but the importance of Mr. Argall's contribution is such as to render it worth while, in the interests of operators of cyanide plants, to get all the information possible concerning the early history as well as the legality of the patent rights surrounding the degassing process; hence the present communication.

One would infer from your editorial comment of Dr. Keith's article that if it could be proved that the idea of removing by means of a vacuum the dissolved oxygen from the solution prior to passing such solution over a precipitant had been previously known, then the Crowe process would not be deemed a new discovery and a novel invention and, therefore, could not be patented. The statement in the opening paragraph of Mr. Argall's letter seems to prove specifically and conclusively that such an idea was known and applied by him at the Independence mill more than eleven years ago. There can be no mistaking or gainsaying Mr. Argall's opening statement to the effect that the object of his communication was to show specifically such application, and if he succeeds—as to my way of thinking he has—in proving that the equivalent to what is known as the Crowe vacuum process was introduced by him and operated in the Independence mill for a number of years prior to Crowe's obtaining a patent upon his process, then it follows that Crowe's process does not constitute "a new discovery" and is, therefore, not patentable.

After making the statement in his initial paragraph that he "intended to show specifically such application," Mr. Argall goes on to describe the basis for his study and subsequent action in the matter of withdrawing the deleterious gases from cyanide solutions containing gold and silver, and makes the important statement that as a result of air-agitation and the loading up of the solutions with gases the prejudicial effects of such gases were recognized, and that shortly afterward the method of overcoming said prejudicial effects was discovered and applied. Here Mr. Argall touches the very pith of the whole matter, as he gives us clearly to understand that he realized at that time that the oxygen contained in the solutions was prejudicial to economic precipitation and that by means of his degassing apparatus he took the necessary steps toward withdrawing the oxygen and other gases prior to passing his solutions over the zinc-boxes. If, therefore, I have correctly interpreted Mr. Argall's statement concerning what he had in mind, and if he did, first of all, recognize the deleterious effect of the oxygen in the solutions upon precipitation in the zinc-boxes, and, if recognizing this condition, he specifically applied the remedy of degassing said solutions prior to passing them over his zinc-boxes, then undoubtedly Mr. Crowe had long been anticipated in his process.

Seeing that Mr. Argall's apparatus consisted of practically the same elements as that comprising the present Crowe process and that as a result of the first unit of his degasser a second unit was subsequently installed at the Independence mill and, furthermore, that the receiver in the second instance was placed vertically instead of horizontally, and moreover that Mr. Argall adopted spe-

solution in order that the filtrate might spray across the vat and cascade down to the solution level, it seems that the Argall degassing apparatus comprises everything that is included in the so-called Crowe vacuum process and aimed at exactly the same mark as Crowe did several years later.

It is my understanding that Mr. Crowe has been the metallurgist for the Portland Gold Mining Co. for several years, and Mr. Argall states that his degassers were in continuous operation from 1908 to June 30, 1915, when the Independence mill was sold to the Portland company. It is very pertinent to the case to ascertain as to whether or not at the time of Mr. Crowe's taking over the position as metallurgist at the Independence mill, he found the Argall degassers in operation. At this distance from the actual scene of operations and with perhaps but a part of the available evidence, it would seem as if Mr. Crowe found the Argall degassing apparatus in operation and performing satisfactorily, and, taking advantage of the fact that this specific idea of deoxygenating the solutions prior to precipitation was not commonly known, he (Crowe) availed himself of the opportunity of getting into communication with the Merrill Metallurgical Co. and describing the Argall degasser to them, and then, either individually or jointly with the Merrill Metallurgical Co., possibly slightly modified the Argall degasser and acquired a patent covering such process.

In view of this circumstance, it is my opinion that were the Patent Examiner at Washinton aware of what Mr. Argall had done in the matter, Crowe would never have obtained his patent, and in view of the fact of the Argall degasser producing practically the same results as the Crowe vacuum process, it would seem as if Mr. Argall is perfectly right in stating that the use of apparatus similar to the Argall degasser is free and unrestricted and that the users of such would not be subject to the payment of royalty to the Merrill Metallurgical Company.

In conclusion, I suggest that it would be interesting to hear from Mr. Argall concerning the economy effected in the consumption of zinc and possibly cyanide in consequence of using his degassers.

T. Skewes Saunders.

El Oro, Mexico, October 3.

The Editor:

Sir—While I do not wish to detract from Mr. Crowe's invention, he having been the first to recognize the importance of de-aerating cyanide solutions—something we knew nothing of then—at the same time the apparatus used in the process or one similar to that described by Philip Argall in your issue of September 20, 1919, was used on the Butters filter-plant of the Standard Consolidated Mining Co. at Bodie, California, in 1908.

The apparatus as designed by Andrew Smith, our master mechanic, consisted of an old boiler set on end with the tubes removed. This was used as a receiver. The receiver connected to the filters and the dry-vacuum pump to the top of the receiver. An automatic discharge arrangement disposed of the solution whenever a certain level was reached. In other words, we always had a partial vacuum above the solution and inadvertently de-aerated or de-gassed solution, which is practically the Crowe process, though our objective was entirely distinct and we failed to recognize its importance.

Whether the result showed any saving in zinc I am not in a position to state, but Major W. H. Landers, my successor, can probably throw light on this point.

New York, October 9. Arthur Feust.

The Roof of Reverberatory Furnaces

The Editor:

Sir—I have read with great interest Mr. Oliver E. Jager's article on 'Prolonging the Life of the Roofs of Reverberatory Furnaces at Anaconda' in your issue of July 19, 1919. I agree with him that building ribs on the roofs of reverberatories is an old idea, but I do not agree that the application of this idea to the modern reverberatory originated at the Anaconda smelter.

While at the Great Falls plant, I was working on the problem of prolonging the life of roofs. The trouble was that one particular spot of the roof was getting so bad and large that it was beyond repair and we would have to shut-down the furnace or let the roof fall. Studying all I could get hold of on the subject, I finally came to the old scheme of building ribs. It was the thing I looked for, because no matter how thin the original roof would be getting, it would be prevented from falling by the ribs. The next furnace that went down for repairs was supplied with ribs. It proved to be a great success. Anaconda then followed suit. So it is the Great Falls smelter that should be credited with the application of this old rib scheme to the modern reverberatory.

Gatico, Chile, September 8. Samuel Fischer.

A method of protecting iron from rust for which very durable results are claimed has recently been described by Prof. Barff and is referred to in the 'Schweizer Elektrotech. Stg.' The iron is treated at red heat with superheated steam, thus receiving a superficial coating of black oxide that offers complete protection against rust. The coating is of a very hard nature and adheres firmly. In some circumstances the coating formed will resist the action of emery paper for a considerable time, while if the temperature is raised to 650°C. and the time of treatment to 6 or 7 hours it will resist the action of a file. Exposure in the open air to rain or moisture for six weeks did not produce any appearance of rust.

Practically all the magnesium marketed in this country in 1918 was manufactured in New York and Maine. As the supply from Germany was cut off, and there was a great demand for its use in star shells, tracer bullets, and trench mortar shells, the United States shipped large quantities of it to the Allies.

The Engineer in Industry

By J. PARKE CHANNING

*Engineers who are in charge of industrial operations and their number is legion—sense as much as anyone the present feeling of unrest in the country and more than anyone else realize the present inefficiency of labor. The two phenomena are closely correlated and no doubt are due to a multitude of causes which it will be impossible to enumerate. From my experience in mining, I estimate that the present efficiency of labor is only about two-thirds of what it was under pre-war conditions.

In the mining industry, at least, we have not a large surplus of men looking for work, and usually under these conditions men are rather more independent and will not work as efficiently and faithfully as if they felt there were plenty of men ready to take their places. Wages in metal mining have certainly advanced more than the increased cost of normal and sane living. The result is that the men often work fewer days in a month and they do not seem to have much interest in their work while actually engaged in it. Then again, they have been listening to the more or less vague propaganda of the I. W. W. and the radical wing of the Socialists, who are harping on the fact that the distribution of newly-created wealth is unfair and that the laborer really is not working for himself or his fellow-laborers but is carrying on his exertions for the benefit of a small and limited class of exploiters. A continued harping on this view is bound to influence the judgment of even a conservative workman who is not a student of economics and who hears little or nothing upon the other side. I am a great believer in the common-sense of the American people and in the long run I do not think that they will be carried away by unsafe doctrines.

The trouble with so many of these propagandists of industrial inequality is that they do not differentiate between production and distribution. Even if we admit that distribution is unfair, unless goods are produced there will be nothing to distribute. A great many unthinking people seem to feel that wages are paid out of a pot which is inexhaustible and do not realize that eventually what comes out of the pot can never exceed what is put into it. The workman is not paid in money but is paid in goods, money as we all know being used simply as a measure of value and a medium of exchange, and that all that can be used to pay the laborer is what he produces.

We hear talk of over-production. As long as there are men with ragged shoes in the United States can it be possible to produce too many shoes? The answer is obvious. If the average worker at Lynn turns out one pair of shoes per day when he could make two, it necessarily follows that the mass of the workmen, who are the large users of shoes, will have to pay just twice as much as they should. The same thing applies to coal, to iron, to steel, and to all of the necessaries of life.

When it comes to distribution, there undoubtedly in the past have been injustices and there probably are injustices today, but there are sane and logical methods of correcting these abuses or inequalities for which all of us should strive.

The annual production of new wealth in the United States is probably in the neighborhood of 50 billion dollars a year, at least that is the figure which is advanced by some economists for the year 1916. As nearly as may be determined between 35 and 40 billions of this goes to the laborers or workmen, as distinguished from those who work with their brains or who are capitalists. This would give a maximum of about $1000 per annum to each one of these workers. If the whole 50 billions were distributed to them they could not expect to get over $1250 per annum. It is manifest, of course, that the laborer cannot expect or demand all this production, because, as we all know, industry will not go on unless it has brains to direct it, and brains must be paid and must be paid better than the man whom he directs.

I am inclined to think that a great deal of the unrest among the laborers is due to the fact that possibly this 40 billion dollars may be inequitably distributed among the different classes of workmen themselves. I have been informed by Mr. W. R. Ingalls, a distinguished member of the American Institute of Mining and Metallurgical Engineers, which organization I represent at this dedication, that he has been at work for a year on an attempt to distribute the income for the United States for 1916. The results of his investigation will soon be published, and in the meantime, I have his permission to quote from some of his deductions as to the distribution in the form of wages. He estimates that for that year 7,000,000 farm laborers received $400 per annum; 7,000,000 farm proprietors received $743 per annum, as a money wage, in addition to which they and their families consumed parts of the products of their farms, whose value probably never entered into any statistics. Seven million two hundred thousand factory workers received an average of $675 per annum; 1,700,000 steam-railway workers received an average of $886 per annum, and 150,000 metal-mine workers received an average of $1250 per annum. If we should still further segregate the steam-railway workers, we would find that certain classes of them were very much higher paid than the average and correspondingly other classes much lower paid.

I am not prepared to say that this distribution is unfair, but it simply shows that there are these differences

*An address delivered on September 29 at the dedication of the Pittsburgh Experiment Station of the U. S. Bureau of Mines.

and that it is just as important to consider if they are unfair as it is to consider the possible inequality of the earned profit to management and capital. I, myself, am not in sympathy with those Socialists who claim that the wage system is a system of robbery. I believe that the wage system is the only system under which production has been successfully carried out and can be successfully carried out, unless perhaps the time might come when human nature was so changed that everybody was equal, both in natural ability and education. It is absolutely false to declare that our present wage system has been the growth of the old feudal system, or that our present capitalists are the descendants of the Feudal barons of the Middle Ages. Every civilized country which has become industrial has by evolution automatically adopted the wage system.

The United States started as a simple community in which almost every family produced all the necessaries of life. It was not influenced by any social system that existed in Europe or in England, and yet in the last one hundred years it has automatically and perforce developed an industrialism based on the wage system. So I take this opportunity of saying that I believe the wage system is one that can be justified to the bitter end.

Capital is created only by saving, and saving means putting aside for other uses part of the production of industry so that when a new plant or a new factory has to be built there is food, clothing, furniture, and houses to take care of the men who are building the new plant and getting it into shape before it is capable, in turn, of producing new wealth. Unless out of this 50 billion dollars worth of annual production some is set aside for new construction and renewals it is easy to see where the country would be in a few years.

I believe that a larger proportion of the savings of the country comes from those of the so-called capitalistic and management class than from the laborers, although the conservative laborer is always saving and striving to increase his wealth. It is a fallacy to say that there is a marked division between the classes of employers and workmen, that the world is divided into "exploiters" and "slaves". There is a constant flux, and the rich man today is perhaps working with his hands in a few years, while on the contrary the laborer of today may be, in a few years, in the capitalistic class, simply on account of his own savings and exertions, and be an employer of labor. There is no such thing as a class struggle.

It is a fact undoubtedly that a great many of the newly rich are improperly using their income. Instead of living in a sane manner and keeping a large portion of their income for new capital investments, they are spending every cent they get in extravagances and are encouraging the production of non-essentials. In the same way, I regret to say, the vast majority of workmen are living up to the handle, and in case of illness or death of the breadwinner have not a cent on hand to tide them over. I think that the rich man who indulges in this extravagance is to be more severely censured than the laborer.

I heard only the other day of a little Englishman who said that before the War he kept on his estate 60 gardeners who were principally engaged in keeping the lawns, flower beds, and hedges in shape, that since the War a large portion of his estate has been turned into agricultural land, that he had reduced his gardeners to 6 and that the other 54 were engaged in the production of food. He stated that he was glad this had occurred and that never again would he return to the old regime.

I believe one thing which has led our unthinking men to harp upon the unequal distribution of wealth is their failure to realize the difference between fixed capital and income. When the proletariat seized the property of the bourgeoisie in Russia he soon found that rugs and furniture and houses would not feed him, and that when the peasants declined to plant more than was necessary for their own use, because they were unwilling to sell the balance for worthless paper roubles, the proletariat in the cities starved by the thousands. We must keep steadily before us the fact that it is the annual flow of production upon which we subsist.

Undoubtedly in the past the employers as a class have been too autocratic and have not taken the workmen into their counsels or treated them as if they were men. There is a feeling that there must be better co-operation between the employer and the workman and I believe that this spirit of co-operation can always be better carried out by managers with an engineering training. Engineering is so intimately connected with all of our production that it cannot go on without it. The engineer, from his very training and experience and his continued contact with the various problems of production, has been made to look at things from an objective and not a subjective point of view. The parlor Bolshevik knows little of the stern realities of industrial life and his theories and suggestions are of but limited value. The engineer, and particularly the engineer-manager, is the main contact between the employer and the workman and the basis of this contact must be the Golden Rule, or as it has been otherwise stated, the principles of justice. If you give a man a 'square deal' he has no 'kick coming.'

In order that this proper appreciation of the human element in industry may be emphasized I am glad to say that most of the engineering schools today have a course in 'Human Engineering', because they realize it is just as important that a man should understand the human machine as it is that he understands the inanimate machine. The older man has got this by experience and the younger man is having it instilled in him in his preliminary technical training.

We hear a good deal today of industrial democracy and I believe a definition of industrial democracy is just as difficult to give as that of political democracy. At a recent convention of 250 manufacturers held at Silver Bay under the auspices of the Y. M. C. A. the concensus of opinion was that the expression 'democracy in industry' was a better term. I am informed that some of the radicals think that democracy in industry means that the workmen should select their foremen and superintendents up to the grade of the general manager, and that he alone should be the one appointed by the company. I consider this is absolutely impracticable. If industry is to

be carried on efficiently the manager the superintendents, and the foremen must be selected by the company. It is here that the greatest care must be taken. The management may have most excellent ideas in regard to its relations with the men, but if the superintendents and the foremen are not well instructed and in sympathy with these ideas the whole desires of the management may go for naught. It is today being more and more realized that foremen should be selected for their knowledge of human nature and their capacity to get on with men rather than for their technical skill in their particular departments.

To my mind, democracy in industry means co-operation with the workmen, in discussing with them the question of wages, hours of work, and working conditions. The question of working conditions is the most important, and on it will depend the health and comfort of the worker and the efficiency of the plant. Many a good suggestion comes from a workman and it is foolish to repress him and not give him an opportunity of making suggestions which if adopted will give him, and perhaps even his associates, the greatest joy of their lives. I had the opportunity the other day of hearing Mr. H. Mensforth of Manchester, England, who is the manager of a large industrial plant and who also is the president of the Manchester District Engineering Trades Employers Association, make an address and the next day I met him personally and got from him a most excellent and illuminating description of the growth and co-operation between the employers and the workmen in England, this co-operation being done primarily between what is known as 'works committees'. Much to my surprise, he told me that this growth was all inside the last three years, that three years ago there probably were not over a dozen works committees in England, and that today he doubted if there were more than that number of shops which did not have these committees.

Such committees, for example, consist of 12 men selected from the workmen and 2 men selected from the staff representing the company. This committee meets once a week on company time and matters are brought up before it on the initiative either of the workmen or of the management. Mr. Mensforth said it was surprising to learn the number of satisfactory decisions which they made and the way in which they eliminated so many previous sources of friction. He said he thought we in America should profit by their experience and have sufficient vision to realize the advantage of this co-operation. He admitted that undoubtedly it would be easier to adjust industrial relations in England, because of the fact that practically all the men spoke English and down in the bottom of their hearts were Britons through and through; they believed in the constitution of their country and had an abiding respect for law and order. He realized that our problem in the United States, with our vast unassimilated mass of foreigners, was a harder one. And right here let me say that I think one of the important things we should do is to carry out our problem of Americanization, and the first thing in Americanization is that a man should learn the English language.

Mr. Mensforth further told me that the management in hundreds of factories realized the importance of education, and particularly of education for the younger men, and that in their works they had established schools in which the younger men were instructed on company time, feeling that this instruction of the men eventually redounded to the company's advantage. Their general scheme was first to try to inculcate in these young men the ideas of good citizenship and then to give them technical instruction in the business. Outside teachers were never used, the teachers always being drawn from their own foremen, engineers, and from among the better class of workmen. The results were threefold: the young men were taught, the foremen were taught, and a bond of sympathy was created between them.

The engineer, then, in his relations with the workmen must realize that first and foremost there must be justice. He must realize that the health of the men must be conserved. No sick man can ever have a sane view of life. He must strive as much as possible to make the workman have an interest in his work, explaining to him the operations which are apparently inexplicable and the bearing which they have upon the industry or the work of the plant as a whole. He must encourage the men toward right living and economy, as one of the greatest desires and satisfactions of life is to own something. He must see that as far as possible his plant is made attractive, because a man feels better and works better in a well-lighted, well-ventilated, and well-kept plant than in a dirty grimy place; and lastly, he must not repress the desires of the workmen to associate, but should encourage his men to get together and to form associations just the same as he, himself, belongs to his various engineering organizations. But at the head of it all, and as his guiding star, he must remember that justice is at the basis of all industrial as well as social relations.

THE New South Wales Government geologist recently visited the Ardlethan tin field and inspected the principal mines, including the Carpathia, White Crystal, New Venture, and Big and Little Bygoo. He expressed himself as pleased with the potential wealth of the field. In his opinion the time is not far distant when the ore will be mined in bulk, as much of the country contains payable tin that is lost or overlooked by the present method of working only the richer shoots. He stated in his report that the Ardlethan field may properly be regarded as a valuable national asset, and everything appears to show that its value and resources are not yet nearly proved or appreciated.

SALT is plentiful in the United States, and more of it was produced in 1918 than in any preceding year, yet the rise in its price helped a little to increase the high cost of living. The average price of salt per ton in 1914 was $2.09; the average price in 1918 was $3.72, an increase of 78%. Producers in the United States in 1918 received nearly $27,000,000, which was $7,000,000, or 35%, more than they realized in 1917.

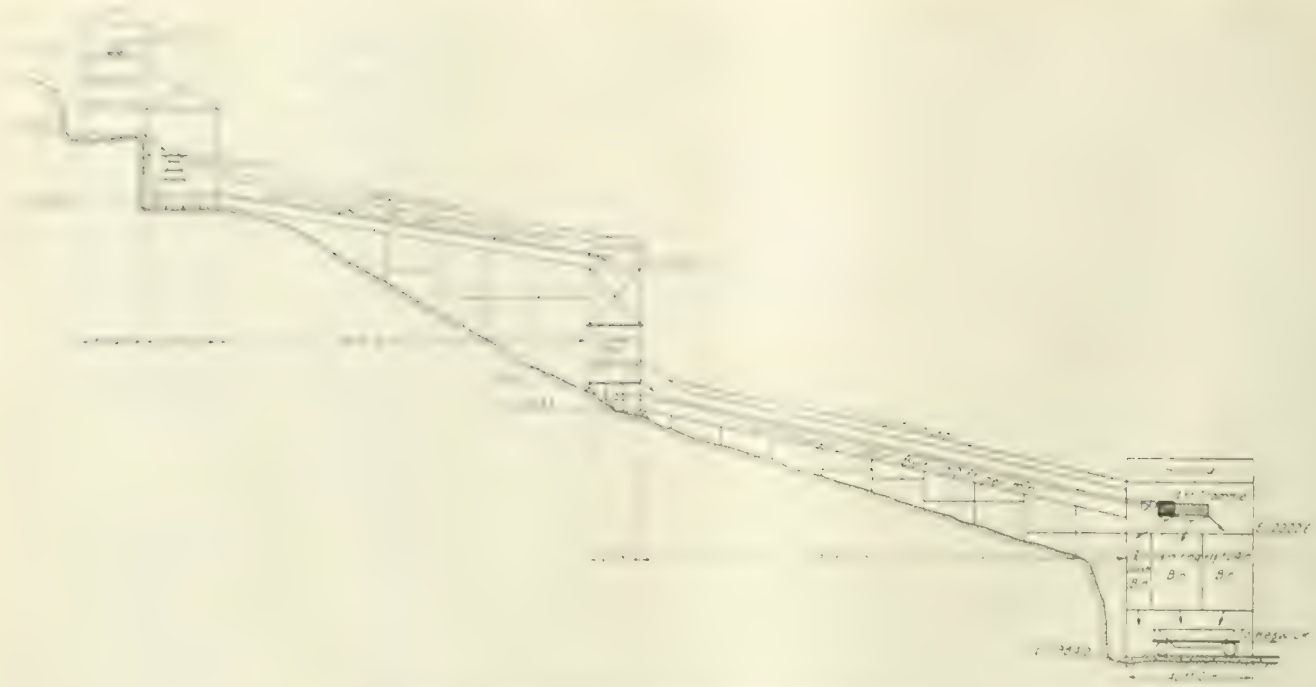


FIG. 1. LONGITUDINAL SECTION OF THE PLANT

The Hornet Crushing Plant

By LLOYD C. WHITE

INTRODUCTION. Reference has recently been made* to the large deposits of sulphide ore in Shasta county, California. The following notes have to do with the methods of preparing the pyritic ore for the market, as applied by the Mountain Copper Company in the exploitation of the Hornet orebody. This orebody is a nearly pure iron pyrite, there being ordinarily not more than 1 to 2% of silica in the ore as mined, so that the only treatment necessary for 80 to 90% of the ore is to crush and size it to satisfy the different customers. The 10 to 20% of ore remaining contains varying percentages of waste, which is the rock that falls when the top of each block of ore is caved in the ordinary course of mining. The treatment of this second-class ore, as it is called, will be explained later.

Previous to 1918 the Hornet ore was all hauled from the upper main adit to the old crushing-plant. Here it was passed through a Blake crusher, set with a 2½ in. opening, and sized into two products designated locally as 'nuts' and 'fines', corresponding in size to about plus 1¼ in. ring to 3 in. and minus 1¼ in. ring, respectively. These products were lowered to the Iron Mountain Railroad bins over a surface shuttle-tramway, in steel cars of three tons capacity. The tramway was about 600 ft. long with a 25° to 30° slope. One man at the top loaded the cars and handled the brakes, while another man dumped the cars at the lower terminal. This tramway was always more or less dangerous on account of the breakage of cables. Owing to the free acid in the ore-dust which penetrated the cables, corrosion was rapid; this action was accelerated in rainy weather.

THE NEW PLANT. Before the exhaustion of the ore above the old main adit, a new tunnel was driven into the orebody some 150 ft. in elevation below the old one. During the period of this work and the time subsequently required in opening up the orebody for mining, a new crushing and sorting plant was built. Thus it may be said that the Hornet was starting life again with a new mine and a new mill. In the design of this plant probably the only point of general interest is the method of transporting the ore from the crushing-plant to the railroad bins. On account of trouble with the old surface tramway, and because the new plant was much nearer the railroad bins, it was decided to employ belt-conveyors to carry the ore. Fig. 1 shows the general arrangement of the plant and the two principal conveyors. In the old crushing-plant the ore was sized (as stated above) and the two products lowered by surface tram to the railroad bins. In the new plant the sizing is done over the railroad bins; this arrangement makes one less bin necessary and enables one conveyor to serve the plant. There is no trouble whatever in the operation of down-hill conveyors on this grade. They are built in the same manner as up-hill conveyors and driven from the head end. As a matter of fact, no driving power is required for these down-hill conveyors; once they are in motion with a load they generate power. The speed must be regulated, how-

*Herbert Lang, 'M. & S. P.', July 12, 1919.

ever, and this is done in the case of No. 1 conveyor by driving it with a small motor through two sets of spur-gears. No. 2 conveyor is driven from the shaft that drives the trommel; therefore any power generated by No. 2 conveyor helps to drive the trommel.

The tower bin between the crushing-plant and railroad bins was built for several reasons: (1) To reduce the grade in the conveyors; (2) to provide additional storage; (3) to make possible the changing of screens on the trommel over the railroad bin without shutting down the crusher; and (4) to act as a receiving and mixing bin for the wet jig-concentrate from the second-class plant. (See Fig. 2.)

To summarize, the first-class pyrite is hauled from the mine to the crushing-plant by electric power; passed through a No. 6 Gates gyratory breaker and conveyed to the trommel over the railroad bins, where it is screened into three sizes, namely, minus $\frac{3}{8}$ in., plus $\frac{3}{8}$ in., minus $1\frac{1}{2}$ in., plus $1\frac{1}{2}$ in., which includes pieces up to 4 in. maximum.

SECOND-CLASS ORE. The 10 to 20% of ore coming from the mine containing waste is dumped into the second-class bin. This ore is fed to a trommel having screens with $1\frac{1}{2}$ in. openings. The oversize from the trommel goes to the No. 3 conveyor, where all the waste is picked off. This waste, in turn, is carried by the No. 4 conveyor to the waste-dump. The No. 3 conveyor delivers its clean ore to the gyratory breaker. About 14-in. pieces are the maximum size handled on conveyors No. 3 and 4. The undersize from the trommel goes by No. 5 conveyor to the jig-storage bin. From here this unsized product is fed by means of a Challenge disc-feeder to four one-compartment Harz jigs. This ore is an ideal material for jigging, as there is no middling product. Every particle is either clean pyrite or clean waste. The hutch product from these jigs is clean ore and flows to a special dewatering bin at the railroad terminal. The 'cup' ore is dewatered and carried by No. 6 conveyor to the tower bin, already mentioned. The jig-tailing goes to the waste-launder.

We now have the various sizes of ore in the railroad bins. The coarsest product, namely, plus $1\frac{1}{2}$-in. ring to 4-in. size is a finished product and is hauled to Keswick over the Iron Mountain Railroad. Here it is transferred to broad-gauge cars and shipped to customers in the vicinity of San Francisco. The finest product, namely, the minus $\frac{3}{8}$ in. and the jig-hutch product are also finished products and follow the same route as the coarsest material.

The intermediate product, namely, plus $\frac{3}{8}$ in. and minus $1\frac{1}{2}$ in., are hauled to Keswick and put through a crushing-plant that yields a final product through a $\frac{3}{8}$-in. screen. Therefore, the final products leaving Keswick are minus $\frac{3}{8}$-in. pyrite and plus $1\frac{1}{2}$-in. pyrite. The uses to which this ore is put and its subsequent treatment by the Mountain Copper Company has been outlined in this journal.†

†July 12, 1919, page 48.

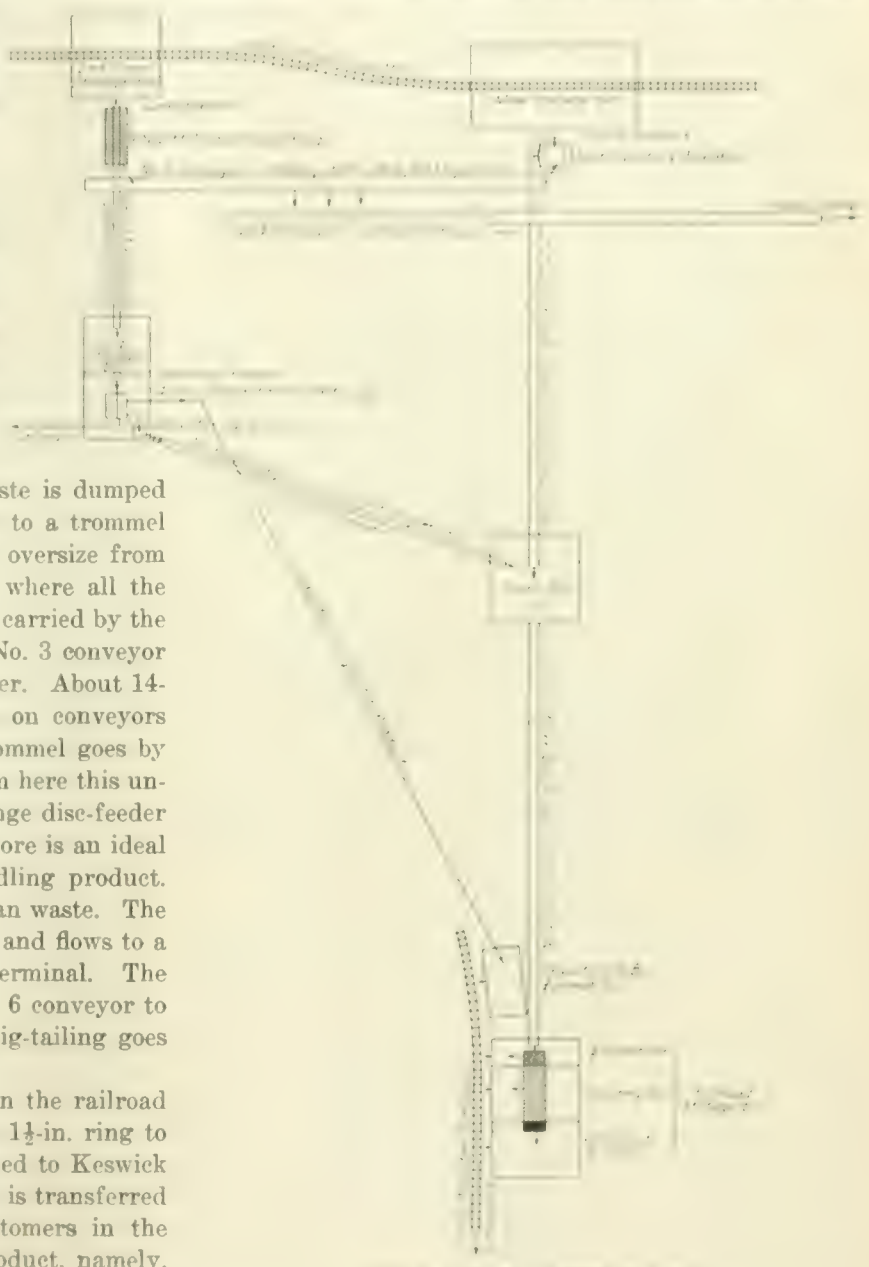


FIG. 2. PLAN OF THE PLANT

MAGNESITE is mined in only two States in the United States and most of the output is used in steel-making plants and for the manufacture of refractory products and sanitary flooring. The domestic producers of magnesite suffered serious handicaps in 1918 by reason of restrictions on freight shipments, of the increase of the imports of magnesite from Canada from 3000 tons in 1917 to 20,000 tons in 1918, and of the use of substitutes for magnesite. Many of the producers who were not equipped with kilns lost business because the makers of magnesite refractory products insisted on having calcined or dead-burned material, which is so much lighter in weight than raw magnesite that its shipment saves half the freight charges. The deposits of magnesite in this country are capable of supplying all the domestic demand, but they are so far from the principal market, which is among the steel plants and the sanitary-flooring plants of the region east of the Mississippi, that their product cannot compete with imported magnesite, if entered at pre-war prices.

A Stable Government for Mexico

By BLAMEY STEVENS

People who have only lived in democratic countries are often too apt to think that they have an elixir for all the ills to which nations are subject. Democracy should rather be regarded as a stage in the evolution of governments; history shows plainly enough that it has been arrived at in an evolutionary way, but people are wont to think that it is a new discovery and that the intermediate stages by which the discovery was made are unnecessary ones for a new and politically uneducated people to take.

Democracy is no new discovery. More or less of it is to be found among the most primitive tribes and nations, quite enough, in fact, to have suggested to the Oriental idealists the possibilities of the modern system. Religions always have been based on democratic principles. But governmental democracy did not develop until the conditions were ripe for it. The fruit does not ripen until it has grown; try to force it to ripen prematurely, and it rots instead. The young bird cannot fly until its wing-feathers are grown; force it, and it falls out of the nest.

At the beginning of the present Mexican revolution practical people, who knew the conditions, advocated a return to a dictatorship. Later the foreign element—and if the facts were known, probably a considerable portion of the native element—have been in favor of 'Cubanizing' Mexico. The great importance of the subject warrants an investigation of the fundaments of government, particularly as they affect the undeveloped peoples.

When Cortez arrived in Mexico in the 15th century, he found the Aztecs had a stable government, and that civilization had therefore made great progress among the natives. That government was a monarchy. The Spaniards conducted a stable government of a monarchical form in Mexico, until the beginning of the 19th century. Mexico City, under the Spaniards, was one of a centre of learning and culture; it had a municipal government, elected by the people, and great improvements were being made. The people of the country were as ignorant as they are now, but, having enough food [illegible]. The revolution of 1810, although due to the shortsightedness of Spanish statesmen, was started by people of the Spanish race and not by the Mexicans. At that time the people of the United States, being politically educated, had been able to establish a successful republican government. For this reason the American colonies that freed themselves from Spanish rule chose republican governments. Of these, none were successful until enough politically educated people migrated from Europe so as to control [illegible]. Mexico has therefore been unable to induce European immigration on a large scale, probably because of its close proximity to the United States.

No ignorant people ever initiated a stable form of national government, based on a purely elective system, and it may be said with assurance that no such people ever will. The natural, or evolutionary, course for them to adopt is that of a monarchy, with a gradual substitution of more democratic forms, as the political education of the people advances.

The Mexican people have as well defined a nationality as the Americans; they are as jealous of the sovereignty of their country, and, except for a stubborn fanatic minority, equally recognize their obligations as one of a family of nations. But this is not all that is necessary. For stable government there must be internal agreement about the choice of executives.

A monarch has a life position, a presidential term only lasts a few years, and even when the monarch dies, the succession is definitely established. A king or emperor is rich enough so that he can afford to be honest. Presidents are politicians, and the more politically ignorant the people, the more do elective politicians become the scum of society. Consequently, presidents of immature republics enrich themselves and their retainers during a short term of office, and with this thought uppermost in their minds they are not likely to devote any supreme effort to administrative duties.

Take the cases of Japan and China: Japan had her revolution when republican ideals had not spread over the world, as they have now. She turned out all the parasitic politicians who had usurped the functions of the Mikado. She returned him to his proper power, and her devotion and loyalty have rested in him to such an extent that it is a religion. Only by thus securing and ensuring her internal unity was Japan able to make such remarkable strides in civilization. She has attained to a fairly democratic form of government. On the other hand, China has waited until modern ideals predominated, and instead of abolishing the mandarins and establishing a strong monarchy with a more or less democratic constitution, she is trying the dangerous experiment of a premature republic. By skipping this necessary link in the evolutionary scale, she has no doubt assigned herself more revolutionary trouble, and if she so persists, will probably retard her progress in civilization many decades.

With the gradual development of political education among the subjects of a monarch, his functions are transferred to officers elected on the basis of party politics. The monarch thus becomes neutral and able to command the respect of all the people, and the two political parties are prevented from falling entirely apart and taking up arms. The Emperor Maxmilian of Mexico was the choice of only one party, the Catholics,

and was thus considered by the Liberals purely as a party man and a foreign invader. The Russian monarchy made the mistake of not pushing the education of the people and of granting the franchise before they were educated. She suffered for these mistakes in such a way that no other country will wish to follow her example. The German government pushed the education of her people, giving them only a limited franchise, and has now emerged as an enlightened democracy. The last step has been precipitated by the War, but in any case it would have happened sooner or later.

It is clear in these days that the proper and safe way to develop a backward people is to educate the individuals, granting them, as they become educated, a certain measure of franchise, but maintaining in the meantime a monarchic balance of control or its equivalent, such as the United States maintains in Cuba and the Philippines. Cuba already had considerable political education under Spanish rule and through immigration from Spain. In spite of her democratic constitution, Mexico has had nothing but a succession of dictators. Having an advanced constitution, she has had a kind of government determined by the political education of the people. She has been without machinery to take care of the succession, and the fact of the illegal existence of the dictatorship has been a continual cause of disturbances. In short, her government has been a lie unto itself. The political education of a people is almost impossible under such conditions. Although the present government may have certain ideas of serving the interests of the people, as others in the past have had, it does not really represent the choice of the people. It is simply accepted as being better than anarchy. In reality, it is an oligarchy, supported by the army. Some of its adherents have a hope of consolidating it into a wholly democratic—even socialistic—government, but this ideal fails to take into account the basic fact to which the actual government must conform, namely, the low average political education of the people.

An oligarchy may be better than a monarchy in that it depends on more than one individual. It may therefore be better balanced in its ideas and not necessarily terminated by the death of one man. But it is liable to split up into conflicting parties and thus to lose the most important property of a government, that of stability. This tendency is well illustrated in the feelings beginning to rage in Mexico in anticipation of the next presidential election.

The party tendency develops in any assembly of people who have political matters to attend to, and if properly controlled it is a good and wholesome tendency. But when the control rests with an ignorant and disinterested populace, it cannot be relied upon. The accession of Porfirio Diaz came about by reason of a dispute as to the election returns, which were controlled by his predecessor. The accession of Francisco Madero came about after a similar dispute, but one which unfortunately did not end by his election. It may be said that this is the general and chronic cause of the starting of revolutions in Mexico. As a result of these revolutions, the people have become educated to the idea that the executive must be elected, and any system of government for Mexico must now be based on this idea of an elected executive. Associated with this idea, however, in the minds of the people, is the old one that the government really rests wholly with the executive; that he is directly responsible for all the adverse conditions which affect the country or any part of it. In the minds of the people he never ceases to belong to one political party, and because of the adverse conditions that party continues to lose ground until nearly the whole population is opposed to it.

France passed through a similar stage, but in her case, not being influenced by the proximity of a great and successful republic, she was able to revert back to monarchy of a legitimate order and so obtain peaceable opportunity to improve her people in balanced political education. England, with a democratic education, dating back to Saxon times, and no more advanced nation to ape, had very little trouble in holding a stable government, and was therefore able to gain wealth and strength in an unprecedented manner, in spite of the easy-going ways of her people and the lack of any commercial organization, such as the Germans have. While the Mexicans, as a people, have acquired the idea of the election of a president, that of the election of other officers of the government had not been inculcated into them; and therefore we may look for the creation of an instrument of governmental stability in this direction.

The function of government, which really calls for the direct will of the people, is that of legislation. If the laws made by the people are obeyed, it really matters very little by whom they are endorsed, so long as in the process there is no dishonesty. The highest honesty obtainable in governmental matters is not that of elected officers, or of officers appointed for a short term by elected officers. The most honestly administered country in the world is said to be India, which is a government of experts, educated up to their positions, well paid, and pensioned.

The most important function for the maintenance of a stable government in Mexico is the control of elections. I suggest that the control of such elections should be in the hands of permanent experts, educated up to their positions, well paid, and pensioned. I believe that the Mexican people would soon learn to put confidence in such a body of experts and to respect them. There are many ways in which the machinery for this purpose might be constructed and arranged and one may be mentioned to show that there is a practical way. Let the functions of the Supreme Court be extended so as to include the policing of the country. Let a body of Rurales, Federal police, be formed under the orders of the Supreme Court and let all elections be in their charge. Instead of having the Supreme Court judges elected by Congress, let them be appointed by the President, because a president is usually a bigger man than Congressmen; he feels his responsibility more and in general would be more honest in such matters. As only two or three judges would be retired in each presidential

term the Supreme Court would never be under the control of any president, and party control would be sure to change every few years. It would, however, be impossible to start such an organization with any one in power, as the opposing party would be suspicious, and with reason, of the appointments made.

American intervention is much talked of, but an intervention initiated by the United States is inconsistent with the covenant of the League of Nations. The Monroe doctrine is acknowledged, but that doctrine does not anticipate intervention. Hence the initiative must come from the League.

The men necessary for the formation of a Mexican Supreme Court, with such extended scope of duties, of power, and of responsibility, are available. They should be men who have taken no active part in politics and are known by their past as honorable and well balanced. Among Mexicans who can read and write the average standard of education and culture is probably higher than that obtaining in the United States.

The franchise among a backward people should not be granted to illiterates; otherwise, it is impossible to get a respectable standard of representatives and officials. All successful democracies have been evolved through a period of limited enfranchisement. De Witte, in Russia, made a fatal mistake of granting the franchise for an uneducated, although apparently tractable population. This gave an opportunity to unscrupulous politicians to gain support by preaching glittering fallacies, and that kind of education led to Bolshevist control.

Candidates for election should not only not be illiterate, but should have had a good education; there is no lack of such material in Mexico. In a country where the basic elements of government have to be constructed, it is much more important to have educated men as legislators, than in a country where only minor modifications have to be made to meet changing conditions. Education in a backward country should include the fundaments of government; political education should not be picked up from spread-eagle orators and I. W. W. agitators.

The written constitution of Mexico is not in the minds of the people the fixed and stable anchor that it is considered to be in the United States; it is rather a code of politics to be reconstructed by any armed political party that may break into power, and it represents the political professions of such a party. As a matter of fact, the written constitution of any country is not of much importance in making for governmental stability. It is rather the constitution evolved in the minds of the people, that which we have previously called political education, that is really the controlling factor. The constitution serves its purpose as a basis for the laws of the country, but want of stability is not due to want of laws or to want of reasonable respect for them by the people in general.

Even within the narrow range of American experience, the evolutionary nature of government has been noticed. Thus Woodrow Wilson, in the Democratic campaign of 1912 said: "We have been praised all over the world for our singular genius for setting up successful institutions, but a very thoughtful Englishman, and a very witty one, said a very instructive thing about that: He said that to show that the American Constitution had worked well was no proof that it is an excellent constitution, because Americans could run any constitution—a compliment which we laid like sweet unction to our soul; and yet a criticism, which ought to set us thinking. Living political constitutions must be Darwinian in structure, and in practice. Society is a living organism and must obey the laws of life, not of mechanics; it must develop. Government is not a machine but a living thing. It falls, not under the theory of the universe, but under the theory of organic life. It is accountable to Darwin, not to Newton. It is modified by its environment, necessitated by its tasks, shaped to its functions, by sheer pressure of life."

The necessity for political education is now seen for the further experiment denominated as the League of Nations. It is clear that the nations are slow to see wisdom in giving up private national privileges to obtain an international democracy; in buying international stability with a surrender of national license. But it is perfectly logical to think that the close analogy which exists between individuals of a nation and nations of a league justifies the inference that international democracy in some form must come as political education advances, and therefore it is only right and proper to begin now, provided that a correct basis is secured and developed by evolutionary means. The Germans thought to benefit the world by an international monarchy, and that might have been an advantage in by-gone ages, but so much of the world is now educated to democracy, that the idea of an international monarchy cannot possibly take root. The change from the idea of international anarchy to international democracy will, however, be slow. Statesmen are accustomed to the entirely selfish national view. The mutual confidence necessary to the attainment of a higher ethical standard is always slow and difficult to attain.

REPORTS received from the shippers by the U. S. Geological Survey show that for the six months ended June 30, 1919, the shipments of high-grade manganese ore amounted to 44,539 tons. The shipments for the first quarter of 1919 were 23,937 tons and those for the second quarter were 20,602 tons. The total shipments of high-grade ore for this period of six months were less than those for the quarter of the year 1918 in which the shipments were lowest—the first quarter—in which they were 55,682. During the three quarters from October 1, 1918, to June 30, 1919, the shipments of high-grade ore showed a steady decrease. The number of shippers of high-grade ore during the first six months of 1919 was only 30, whereas the number for the year 1918 was 247. The total shipments of low-grade ore containing 10 to 35% of manganese for the six months ended June 30, 1919, were 86,158 tons. The total shipments for the six months were nearly two and one-half times the total for the first quarter of 1919. The shipments of ore containing 5 to 10% manganese were 130 tons for the first quarter of 1919, and 16,741 tons for the second quarter.

FROM OUR OWN CORRESPONDENTS IN THE FIELD

ARIZONA

CALUMET & ARIZONA DEEPENS—NEW OIL BOOM NEAR DOUGLAS.

BISBEE.—The Campbell shaft of the Calumet & Arizona Mining Co. is being carried down from the surface to join the raise which was completed several months ago at a height of 669 ft. above the 1300-ft. level. The raise has two and a half compartments, and the shaft two compartments. Later, when the two have been joined, it is intended to enlarge the shaft to conform with the company standard and to line it with concrete. The shaft now has reached a total depth of 270 ft. The Night Hawk lease, which recently opened a body of high-grade ore on the 650-ft. level, has developed a large tonnage during the last few weeks, with the result of increasing the confidence of its owners and the general public in the permanency of the orebodies in the vicinity of Don Luis, a hitherto neglected section of the Warren district.

DOUGLAS.—Mining interest here was superseded recently by an oil boom which has caused several hundred local people to locate land in the Sulphur Springs valley and the San Bernardino valley, just across the Perilla range from the city of Douglas. Altogether between 500 and 600 local people have filed locations on land in that region, where geologists have declared there is strong indication of oil. Arrangements have been made to bring three rigs into the field and at least one drilling contract with a six months clause has been signed. Considerable patented land not open to location has been leased.

AJO.—New Cornelia Copper Co. probably will erect a smelter and refinery here in addition to the 10,000-ton flotation plant, according to John C. Greenway, general manager. The 500-ton flotation plant, which was used as an experimental mill, is working smoothly and satisfactorily in every way, the recovery being good. The test in the 500-ton mill will be completed in about ten months. Upon these results will be based the permanent construction, which is expected to start soon thereafter. It is hoped that as soon as the steam-shovels have reached the sulphides in the pit the permanent flotation plant will be ready for operation. At the outset a unit of 5000 tons will be used; at the same time the leaching-plant will be treating a similar tonnage, making a total of 10,000 tons daily. To avoid taking the concentrates to Douglas permanently, which is the present practice, a smelter will probably be constructed on the property. The leaching-plant will outlive its usefulness in from six to eight years, when all known carbonates will have been treated. That will not mean discontinuance of shipments of refined copper, as a refinery will be built upon the leaching-plant site. In the event that this is done, Ajo will continue to be the only mining camp in the State that does not have to send its copper eastward for refining. By the time the leaching-plant has completed treatment of all the carbonate ores, another 5000-ton unit will have been added to the flotation plant, which then will have a daily capacity of 10,000 tons. The proposed increase in tonnage treated daily would mean an increase in production from about 40,000,000 lb. annually to approximately double that amount, since the sulphides average higher in copper content than do the carbonates now being treated. New Cornelia then would rank among the first producers not alone of Arizona but of the West.

TUCSON.—A two and a half compartment shaft now is being sunk on the property of the Arizona-Tucson Copper Co., in the Tucson mountains, 8 miles south-west of Tucson, it being the intention of the company recently organized to explore the property at depth to ascertain whether or not the high-grade ore existing in the glory-hole a few feet under the surface continues with depth. The glory-hole shows an orebody between 30 and 40 ft. in width to a depth of 60 ft. The shaft is being sunk about 100 ft. from the old shaft and in the main core of the ore-chimney.

PATAGONIA.—The Three R mine, a silver-lead property worked spasmodically since the days of the civil war, has been bonded by the owner, R. R. Richardson, to the Magma Copper Co., which is to take possession the latter part of October. The Hardshell company is sinking a double-compartment shaft, which now has reached a depth of approximately 400 ft., the object being to cut a vein already tapped by an incline-shaft. The vein is expected to be cut at a depth between 700 and 800 ft. The Mowry mine is making an excellent showing, shipping an average of a carload of lead carbonate and galena daily to El Paso for smelting. The mining is being done on a new orebody encountered a few months ago on the 260-ft. level. This is an extension of the big orebody worked in the early days of the mine. The Pierce-Gardner property is shipping an average of four cars weekly of silver ore to El Paso, netting around $1000 per car. The property was opened up in the war period for manganese and for a time was active in shipping for that metal only. About eight months ago Mr. Pierce assayed samples of the manganese ore for silver and found the silver content so high that it was decided to push mining and development work in order to take advantage of the high silver prices. The main shaft has reached a depth of only about 150 ft., but ore has been mined almost from the surface by underhand stoping methods. Three shifts approximating

a total of 30 men now are employed. The Flux mine now has about 100,000 tons of ore blocked out, 60,000 tons of carbonates and the remainder sulphides. An active campaign of development is about to be started which, when completed, should add greatly to the ore-reserves. The company plans to build a smelter of 100 tons capacity about the middle of next year. The mine is developed to the 130-ft. level, a total of about 5000 ft. The glory-hole extends from the surface to the 70-ft. level and is about 100 ft. square. On the 100-ft. level the orebody measures 400 by 250 ft. of solid carbonates. The change from the carbonate to the sulphide zone takes place at the 130-ft. level. A winze extending from the 130-ft. level to a depth of 130 ft., a total vertical depth of 260 ft., is in solid sulphides, running from 7 to 11 oz. silver and from 11 to 19% lead. A 100-ton mill, a combination of gravity and flotation processes, is on the property.

COLORADO

LEADVILLE AND CRIPPLE CREEK.

LEADVILLE.—A company is being organized by A. A. Garrett and associates, to be known as the Prospecting Mountain Tunnel & Development Co. to drive a tunnel into Canterbury hill to explore veins and dikes believed to extend from Fryer hill into the mountain. The proposed tunnel will be driven 5000 ft. in a direction approximately S 25° E, cutting through the southern end of Prospect mountain. The depth directly under the summit of Canterbury hill will be 700 ft.; under the Roseville shaft 250 ft.; and under the Minneapolis shaft 500 ft. High-grade ore was mined in the Roseville when sunk in 1881. Water was then encountered and work abandoned. Manganese ore is reported to have been found at the 350-ft. level of the Canterbury shaft. Leadville mining men have subscribed liberally to the organization.

A good grade of zinc ore is under development by lessees of the Shamus O'Brien on Yankee hill. In the same vicinity the Bull's Eye claim of the Iron Silver Mining Co. has been leased and the lessee, Alfred Swanson, has secured a contract to supply the Pueblo smelter with 500 tons of argentiferous iron ore. A vein of silver-bearing ore has been opened on the Sailor Boy in Lincoln gulch by George Nichols and associates. Arrangements have been made to continue at work through the winter months. The Ruby mine, owned by a British syndicate, has been leased to W. Kirby and Aspen associates. The property when last operated was a producer of high-grade silver ore. John Cortellini and Leadville associates have taken leases on the Dolomite, Echo Laurel, and General Grant properties in the Adelaide Park district. This region has been little developed, but is known to be heavily mineralized from the surface workings on the group. The Clear Grit, in Iowa gulch, will shortly resume under lease to Frank G. Peck, president of the Portland company of Cripple Creek. Linemen are now connecting up with the power line of the Colorado Power company.

CRIPPLE CREEK.—Stockholders of the Isabella Mines company are invited by a circular letter signed by C. M. Carson, vice-president of the company, to participate in the organization of the Isabella Leasing company, formed for the purpose of further development of the Isabella estate on Bull hill. As set forth in the letter, development on company account has been impossible "because of the advance in price of mining material and labor, occasioned by the War." The lease, it is understood, will be granted the new company for a five-year term, with the privilege of a three-year extension, and royalties on ore marketed will be on a sliding scale. The ground included in the lease extends from the eleventh level of the Lee shaft to the bottom, or fifteenth, level, west from the west sideline of the Orphan No. 1 and includes the Orphan No. 2, Ida Bell No. 1 and 2, Emma No. 1, Comet and Jack Rabbit lodes No. 1 to 4 inclusive, Ex., J. Gold, Bully, and Tom Thumb lode claims. It is proposed, according to the circular, to start work on the 15th level of the Lee shaft, taking advantage of a cross-cut 1000 ft. long and to continue the cross-cut 300 ft. to cut the Sump and Buena Vista veins. The veins would then be cut at a depth of 450 ft. below the Buena Vista and Sump ore-shoots that produced approximately three million dollars. It is further proposed to continue the cross-cut some 200 ft. farther to explore the junction of the Buena Vista and Maloney veins, the No. 2 vein, No. 3 vein, and finally the Emma vein. All of these veins have produced ore in the upper workings. Subscriptions to the leasing company stock will be limited to 6000 shares of the par value of $1 each.

The Modoc Consolidated Mines Co. is now shipping at the rate of from 60 to 75 tons daily. The new ore-house has been completed, the hoisting capacity increased by use of the counterbalance in the three-compartment No. 2 shaft, and track laid to the ore-house to permit loading ore direct. It is estimated 15,000 tons of ore lies broken in the filled stopes at the 1200-ft. level, and the work of pulling the stope has commenced. The rock will sort, it is estimated, to fully 5000 tons of shipping-grade ore ranging in tenor from one to five ounces gold per ton, the higher tenor obtaining in the screenings. Deep development and exploration of the Combination claim will, it is reported, soon be commenced, when the labor situation is improved by the return of miners to the district for the winter months.

The machinery at the Gold Coin shaft of the Granite Gold Mining Co., situated in the city of Victor, is to be dismantled and sold. The plant was one of the most costly ever installed in the district. The veins of the Gold Coin have been worked out to the bottom or 1200-ft. level, and except for scattered bunches of ore now being cleaned up by lessees no work is being done on this end of the property. The labor shortage is serious, and but for the fact that miners are expected to return to Cripple Creek for the winter, the situation would be critical. Both the Portland and Cresson mines are operating with greatly reduced forces, but as a higher wage-scale cannot be paid, men are leaving for other districts.

La Plata.—After a temporary period of activity, production has come to a standstill, although development continues on many of the properties, and on a few a force of men will be employed during the winter months. McCloskey & Co. are leasing the Bessie G. to Grisenti & Co. for a period of two years. The lessees recently made a small shipment carrying gold. The Eagle Pass M. & M. Co. has leased the upper workings to B. Caramouziz & Co. for a year; ore is being packed out from the Durango Girl; the Boren Gulch M. & M. Co. has opened up a run of good milling ore.

Rico.—Shipments are not heavy since the closing down of the Marmatite M. & M. Co. operations, but development continues. The Rico Argentine M. Co. compressor repairs are completed and a force of men is at work getting out ore for shipment. The Rico Wellington Mining Co. has completed the extension to its tramway, and is now shipping high-grade copper ore. The Rosebud mill is about completed, and the Silver Gulch M. & M. Co. expects to commence milling by November 1. The Gold Anchor group, situated on Calico Peak, and consisting of the Johnny Bull, the Gold Anchor, the Gold Anchor Extension, the Silver Queen, the Last Effort, Caledonia, Cambria, Albion, Owl Tunnel, Owl Lodes No. 1, 2, 3, and 4, Spanking Jack, and Legal Tender claims, has been leased for three years under a bond and lease to Virden & Thomas. Recent trial shipments brought excellent returns, the ore carrying 30% copper, and 3 oz. of gold. After a period of development work, the lessees on the Telegraph vein of the Resolute are shipping ore.

Ophir.—The Ophir Gold Mining & Reduction Co. continues development of its holdings, the April Fool and the New Dominion. A body of milling ore has been developed, 2500 ft. of driving having been completed.

MICHIGAN

INTEREST IN PROSPECTING OPERATIONS.—ACTIVITIES AT THE COLLEGE OF MINES.

Mining men in the Lake Superior copper district today are watching closely the development and prospecting operations conducted at properties that are in the prospect stage. At all the active producers of copper there is nothing of unusual interest to report, production going forward at a figure which indicates plainly enough the ability to increase the amount at any time such action is considered necessary, although the evidence is that no such step is to be taken in the immediate future. Work at such exploration properties as the Mayflower, Seneca, the Hancock Con., and the expected resumption of operations at the Arcadian and the Bear Lake are attracting more attention than the steady progress of events at the big producers. At the Mayflower-Old Colony shaft there is no material change in the underground conditions, no lateral work going forward, and the shaft itself remains in solid trap-rock. Shaft-sinking will continue for at least another 100 ft. It is expected that when that depth is reached the geological structure will be evident. The particular interest in this work at the Mayflower is to see if the shaft will intersect the ore that was shown in the drill-core. In this district development does not always check the results found by diamond-drilling. The Indiana is an example of that sort of thing. The Indiana core was the richest ever taken out of any property on the south range of the Michigan copper district, causing such a sensation that the stock of this remarkable prospect went as high as $32 per share and couldn't be bought at that figure, yet nothing like that drill-core ever has been found by development. The second reason for the

TOP OF 25,000-TON ORE-BIN, RAY CON. COPPER CO. CONCENTRATOR, HAYDEN, ARIZONA

interest in Mayflower rests in the fact that it is out of bounds. If copper is found in the shaft it will upset many geological theories of the Copper District. It would open possibilities in a direction that never have been considered promising, for the Mayflower is supposedly outside the mineralized zone. In that case a Calumet & Hecla subsidiary, the St. Louis, would have new possibilities, and many other explorations would be started. The management of this property has been compelled to do its work slowly and with many handicaps, but has continued, in spite of natural disadvantages, to work out its theory along the only lines practicable.

The Seneca is going ahead with the opening of the Kearsarge lode and is considered to have a promising future. It is accumulating a small stockpile and getting the shaft down to the third level. In the meantime plans for the new stamp-mill will be undertaken in the spring. The stock-pile accumulation will be milled at a customs plant whenever it reaches proportions that warrant a mill-head operation. Hancock Con. opened again on October 20 with four machines at work developing the Pewabic lode south of the shaft. More machines will be added each day until the total working force reaches 200. The drills will be put to work with the idea of opening up the lode in as many places as possible, so that when hoisting starts it may continue uninterruptedly on a basis of large production. This is the only possible solution of the Hancock problem.

The Concord is the name of the consolidated New Baltic and New Arcadian properties. These companies hope to be able to finance future operations by means of stock which may be sold from the treasury. Arrangements for marketing this have been made with Eastern brokers. While the total amount of money expended in the work in this immediate vicinity has been large and the results attained have been unsatisfactory, there is, nevertheless, hope for success in the future. The Bear Lake property is another concern which is away from the recognized zone of mineralization, but the drill-cores showed good copper and the money has been raised in the East to back up further development. Michigan is another old property which has a chance of turning from a failure into a success in the near future. Michigan was the old Minesota in the early days of Ontonagon county development. It has one chance of making good now, that is, by doubling production. The Chicago, Milwaukee & St. Paul railway is building a spur into the shaft-house. The grading for this work will be completed in a week and rails ought to be laid by January 1 if the difficulty of securing the rails is obviated. Twenty-two machines are working in the shaft and every opening is in a grade of rock running 25 lb. at least in copper. Quincy is adding to its present equipment of Deister tables at the stamp-mill.

Representatives from [illegible] of the Michigan College of Mines attended a re-union at Maple Grove resort, Wisconsin, October 17, 18, and 19. William Kelly, president of the Board of Control and Prof. Walter McNair, president of the College, gave addresses.

The students organization of the Michigan College of Mines elected officers as follows: president, R. G. Satterley; first vice-president, Lester Vocke; second vice-president, W. J. Kline; third vice-president, H. C. Blake; secretary, J. M. Flannigan; treasurer, James T. Fisher. The college has the largest freshman class in 15 years.

NEVADA

DEVELOPMENTS AT THE EUREKA CROESUS.—LABOR SITUATION IN TONOPAH AND DIVIDE.

EUREKA.—The Mining & Development Corporation, the new owner of the Richmond-Eureka Mining Co., is reported to be prepared to spend $1,000,000 in re-opening the Eureka Consolidated and Richmond mines, which have been idle since 1910, when a production of 150 tons of silver-lead ore daily was discontinued owing to the suspension of operations by the Ruby Hill railway following a bad wash-out. It was estimated at that time that there was 1,500,000 tons of ore of shipping-grade exposed in the two mines. Among the stockholders in the Richmond-Eureka were Henry C. Frick, of the U. S. Smelting, Refining & Mining Co., John H. Mackenzie, William Fries of San Francisco and of the Charles Fries estate of New York. The mines were discovered in 1864, five years after the Comstock was found; one of the stockholders of those days was John W. Mackay. The production to 1910 is estimated at $70,000,000.

Ore assaying $200 in silver, lead, and gold is exposed for the width of a drift in a new discovery made on the 400-ft. level of the Dunderberg workings of the Eureka Croesus and a 45-ft. cross-cut is still in ore. The winze from this level, south of the old workings, is 285 ft. deep and is being continued in ore assaying over $100. A 4-ft. width of ore assaying $125 has been opened in a drift being driven north on the 200-ft. level and in a shallow winze from the west drift on the same level ore assaying 100 oz. silver, 15% lead, and 3½ oz. gold has been cut. The west drift has been in ore of shipping-grade for 35 ft. and is being continued to open heretofore unexplored territory. A 160-hp. engine, 12-drill compressor, and a hoist are due to arrive in a short time and will be erected at the Catlin shaft, which will then be sunk 400 ft. more to a depth of 800 ft. and exploration started from the bottom for the extension of the ore-shoots opened on the 400-ft. level.

GOLDFIELD.—The south-east cross-cut on the seventh level of the Florence has been driven 155 ft. from the south drift. The west cross-cut on the same level has been driven 290 ft. into the foot-wall of the vein. A direct charge of $6.30 per foot is being made against this work, which, with overhead charges, makes a total cost of $10 per foot. The south-east cross-cut when complete will be 1200 ft. long; it is estimated that the total cost will reach $15,000. This cross-cut will be driven south-east to a short distance west of the Aurelia lease shaft in the Cornishman claim and then will be turned south into the leased Golconda claim of the Red Hill. The west cross-cut will have to be driven nearly 500 ft. to

reach the boundary line of the leased Combination No. 2 claim of the Development company, and may be extended several hundred feet into the claim before driving is started. The Florence Divide lease is increasing the rate of shipment. Returns on the eighteenth, nineteenth, twentieth, and twenty-first cars sent to the smelter give a tenor respectively of $342, $61, $103, and $146 per ton. Preliminary estimates put a per-ton valuation of $130, $83, and $50 on the next three cars shipped. Eleven lessees are developing blocks, all with exception of the Florence Divide on a small scale. J. B. Witt, who, with C. W. Brandon, discovered the Florence Divide ore-shoot, has taken a lease south of the old Riley block and is working at a depth of 258 ft. Adamson, Traynor, and McCall, leasing near the Nevadan shaft, the farthest north in Florence ground, are saving ore breaking $27 with assays as high as $387 being obtained from a narrow vein. J. B. Kendall, former manager for the Consolidated, has four miners employed in driving raises on the 258-ft. level near the east side-line of the Cornishman claim. A carload of ore estimated to be worth from $40 to $50 per ton is broken in the Dorsey lease. In a raise from a 90-ft. cross-cut at a depth of 420 ft., 10 ft. of ore assaying $9 has been opened in the Cracker Jack. The vein, dipping east at an angle of 45°, was cut 25 ft. above the cross-cut, which is from the bottom of a 100-ft. winze from the 320-ft. level. The cross-cut is being continued and is expected to enter the vein within 40 ft. Drifts are being driven north and south from the top of the raise, the face of the former assaying $12 and the latter $17. In a cross-cut from the 60-ft. point in the winze in August, 8 ft. of ore assaying $25 was opened. The work is being done in the Columbia Mountain fault, far north of the proved zone in the Goldfield district.

COPPER CANYON.—Miners and craft men employed by the Copper Canyon Mining Co. have returned to work following a settlement of the strike under which miners receive $5 and craft men $5.50 per day, the same wages as were paid by the company before the walk-out. The board charge was fixed at $1.25 per day, a gain of 25c. for the strikers. According to F. Sommer Schmidt, manager for the company, the main issue was the right to refuse to re-employ strikers at the discretion of the management, which was won by the company in the negotiations conducted through Robert F. Cole, State Labor Commissioner. The Copper Canyon is controlled by the Whicher interests of New York.

DIVIDE.—During the past week the labor situation showed marked improvement in both Tonopah and Divide and no further trouble is feared pending the demand expected within a short time from the newly organized Tonopah-Divide Miners' and Millmen's union. What will be embodied in this demand is not known, but it is believed a settlement will be made for a 50-cent increase in wages. It is reported that the Divide operators are willing to pay increased wages, but the situation is confused in Tonopah, where some of the companies are paying the way of miners into the district. It is reported that Governor Boyle and George Wingfield, one of the principal Divide operators, are to hold a conference within a few days. The governor is now in Ely, where it is reported the I. W. W. is trying to cause labor trouble. The injunction against I. W. W. activities in Tonopah and Divide has been made permanent. This is said to be the first instance in which a State has fought the I. W. W. to complete defeat in the courts.

ARROWHEAD.—Many locators in the new Arrowhead district, in Nye county north-east of Tonopah, are developing their claims with good results. The ore is silver sulphide and is found in well-defined fissure veins. The Arrowhead Mining Co., controlled by Tonopah men, has sunk where the original discovery was made a shaft

VIRGINIA CITY AND THE MINES OF THE COMSTOCK LODE

that is 175 ft. deep. In lateral work at 100 and 175 ft. high-grade ore has been exposed. In a drift on the 100-ft. level 54 ft. of ore assaying $32 in gold and $199 in silver is exposed, according to J. B. Kendall of Goldfield, who recently inspected the district. Rich ore has also been opened at three places on the 175-ft. level and at this depth a 20-ft. cross-cut has failed to disclose the width of the vein.

UTAH

PRODUCTION FOR 1919.—LEGAL DECISIONS. DIVIDENDS.—GENERAL NEWS.

SALT LAKE CITY.—For the first nine months of this year, Utah mines distributed a total of $8,172,320 in dividends, as compared with $19,000,000 and $29,000,000, respectively, for the same periods in 1918 and 1917. This heavy decrease is due to the unsatisfactory condition of the metal markets during the period, which resulted in practically all of the larger mines curtailing their operations, or closing down completely. Of the above total, Utah Copper leads with $7,318,000; Tintic Standard, $282,000; Bingham Mines, $111,000; Eagle & Blue Bell, $90,000; Daly Mining, $67,000; Judge M. & S., $60,000; South Hecla, $39,525; Iron Blossom, $25,000; Grand Central, $24,000.

Probably the most pleasing item of news to come over the wires for some time was the announcement during the past week that the A. S. & R. company had increased the price of lead from 6¼ to 6½ cents per pound. While the advance is not great, it is encouraging to local lead-mining men, as Utah produced in 1918 about 167,000,000 lb. of the metal. The advance of ¼ cent, based on the above production, means an increase of practically half a million dollars in the State's mineral output, and with the increased price of silver will probably do much to stimulate mining in a number of districts almost forgotten.

In the case of the United States v. the Silver King Consolidated Mining Co., which has been on trial before the United States District Court in this city, a directed verdict in favor of the defendant was given to the jury by United States District Judge Tillman D. Johnson. The Government sought to collect income tax on approximately $640,000, which was paid to the defendant as a judgment, for ore extracted, by the Silver King Coalition Mines Co. in 1913. The mining company contended, in the argument for a directed verdict, that the claim on which the judgment was paid was owned by the company at the time of the incorporation of the company in Utah in 1908 and, therefore, not income subject to tax under the income tax law in 1913. Local officials of the Internal Revenue Department will take the question up with the Collector of Internal Revenue at Washington regarding an appeal of the case.

The fall semester at the University of Utah began on September 29. At the present time there are 275 students in the School of Mines and Engineering Department. [illegible]

After having been dormant for six years, 'Mines and Methods' made its reappearance on October 17. It is stated that the paper soon will be changed from a monthly to a semi-monthly publication, and ultimately will be issued once a week.

Announcement has been made that the United States Bureau of Mines will send to Utah a geophone to be kept permanently in this district. This news was made public by Carl A. Allen, engineer for the Bureau and Chief Mine Inspector for Utah, who has just returned from a trip to Pittsburgh and Washington, D. C. The geophone is an instrument which attained a highly developed stage during the late war, and is now being turned to peace uses. Its principal use is detecting the location of sounds underground; such as rapping by entombed miners, and the grinding of diamond-drill bits or the noises of air drills, in approaching headings, such as tunnels. The geophone is a good deal like a physician's stethescope, and one inventive genius has found that it can be used for detecting the 'knocks' in an automobile engine. Underground, in hard rock, sounds have been detected by the geophone at a distance of 1500 ft. Sounds traveling 1200 ft. through coal have been noted. The geophone is practically indestructible, and could be dropped down a raise from a height of 100 ft. without being hurt.

The United States Supreme Court, on October 20, issued a writ of certiorari to the Silver King Coalition Mines Co. in the case brought against it by the Conkling Mining Co., and the case will be set for trial before the highest tribunal in the country. The case was appealed to the Supreme Court after judgment had been awarded the plaintiff to the amount of $570,000. The United States District Court in Salt Lake City had first decided in favor of the defendant, but after the decision had been reversed by the Court of Appeals and returned to the local jurisdiction, judgment was given the plaintiff. Issuance of the writ means that the case will be given its final hearing before the United States Supreme Court.

PARK CITY.—For the first nine months of the current year, Park City shipments of ore totaled 54,933 tons, valued at $3,100,000. The Judge M. & S. Co. shipped 17,420 tons; the Silver King Coalition, 14,687 tons; the Ontario Silver, 14,339 tons; the Daly-West, 3386 tons; the Naildriver Mining, 2024 tons; the Daly Mining, 2328 tons; the Silver King Consolidated, 710 tons; and the Iowa Copper, 44 tons. Of late, all mines have been increasing their output, due to the advance in lead quotations and the high price of silver. Shipments of ore for the week ended October 17 were as follows: Silver King Coalition, 666 tons; Ontario Silver, 551 tons; Daly Mining, 159 tons; Daly West, 404 tons; Judge M. & S., 331 tons; Naildriver Mining, 58 tons. Labor conditions are satisfactory; all mines reporting plenty of men and a gradual increase in efficiency.

The State Board of Equalization, which has been investigating and examining properties in the Tintic district for assessment purposes, has been in this district during the current week looking over improvements and equipment on mining property here.

Physical conditions of an encouraging and interesting

nature are being encountered in the development which is being done at the Three Kings mine, according to P. J. Mackintosh, general manager. The most important work at present is the sinking of a winze upon the ore in fissure No. 4. This winze will be sunk until the quartzite-lime contact is encountered. Ore is being taken from the raises, and there is a carload en route to the smelter.

TINTIC DISTRICT.—Shipments of ore from forty mines in the Tintic district for the first nine months of the present year are estimated at 5197 carloads, or approximately 250,000 tons, valued at $7,500,000. The output during September was 499 carloads. The principal shippers from the district, for the period above mentioned, were as follows: Dragon, 894 cars; Chief Consolidated, 872 cars; Centennial-Eureka, 334 cars; Iron Blossom, 553 cars; Colorado, 326 cars; Eagle & Blue Bell, 314 cars; Tintic Standard, 688 cars; Mammoth, 238 cars; Grand Central, 282 cars; Gemini, 135 cars; Empire Mines, 129 cars; Swansea, 100 cars; Ridge & Valley, 82 cars; Victoria, 57 cars; Gold Chain, 23 cars; Bullion-Beck, 28 cars. For the week ended October 17, shipments from the district totaled 114 cars, a decrease of 15 cars, as compared with the previous week.

Work of sinking the south shaft at the Tintic Standard Mining Co.'s property was taken up recently by contractors who have undertaken to sink the double compartment shaft to a depth of 1500 ft. The present depth of the shaft is 1050 ft. This sinking is preliminary to the development of the south end of the property. As soon as the shaft reaches the 1500-ft. level, extensive prospecting will be taken up. This property is now the second largest silver producer in Utah.

After re-timbering and repairing the shaft of the Yankee Consolidated Co., fixing up stations and cleaning out drifts, work has been taken up in behalf of both the Yankee and May Day companies. Some time ago the May Day company made arrangements for a campaign of deep work to be handled through the Yankee shaft at a depth of 1800 feet.

Officials of the Grand Central Mining Co. state that the mine is looking exceptionally well at the present time, and that considerable new ore is being opened up. The advance in the price of silver is helping to some extent, although Grand Central ore also carries gold and copper.

THE UTAH-APEX LEAD MINE, BINGHAM DISTRICT, UTAH

The contract for sinking a shaft at the property of the Tintic Paymaster Co. has been awarded to Duncan & Moore, contractors of Eureka. The shaft is now at a depth of 340 ft., with a flow of water coming into it at the rate of 40 gallons per minute. It is planned to bring this water to the surface, where it will be of great value to the company.

The directors of the Iron Blossom Co. have declared a dividend of 2½ cents per share, or a total of $25,000, payable to stockholders on December 25. This will bring dividends for the current year up to $50,000, and the grand total to $3,260,000. Conditions at the mine are encouraging, and the high price of silver is adding materially to earnings.

Officials of the Eureka Lily Co. report an east-west

cross fissure encountered on the 1700-ft. level. When first struck the fissure, which carries a good grade of ore with silver, lead, gold, and copper, was 18 in. wide, but within a few feet of sinking it has widened to 3 ft. Physical conditions in the south drift from the main shaft of the 1665-ft. level indicates that the quartzite-lime contact is being approached. The face of the drift, which is now 450 ft. from the shaft, is highly mineralized. When this contact is reached, it is expected that the Tintic-Standard ore zone will be encountered.

ALTA.—The South Hecla Co. has shipped approximately 6000 tons of ore since June 1. The September output was 1000 tons; August, 1500; July, 1700; and June, 1800. There are two grades of ore being shipped; silver-copper sulphide and lead-silver carbonate, with an average value of $25 per ton. During the past quarter the company paid a dividend totaling $39,450.

The Wasatch Mines tunnel is rapidly nearing the old shaft leading to the 400-ft. level. This shaft is filled with water for 200 ft., and as the tunnel approaches, is gradually being drained, so that mining may be resumed. The bore is now in a distance of 5080 ft., and is progressing at the rate of 8 to 9 ft. daily.

Through a deal which has just been closed for the control of the Copper King Co.'s claims in Big Cottonwood canyon, consisting of seven patented claims, the Big Cottonwood Coalition Mines Co. rounds out the largest property in the camp, having a total of 61 claims and fractions. By this deal the Coalition company adds 160 acres to its territory. Contract has been let for 400 ft. of additional work in the tunnel, which will carry it to the junction of the Cooper, Copper King, and Prince of Wales veins. The face of the tunnel is now in 2155 ft. Shipments from the Copper King, about a year ago, averaged 0.1 oz. gold, 2.5 oz. silver, 4.0% lead, and 6.85% copper.

BINGHAM.—Mining operations have been resumed at the Utah-Apex property. The mine, for several years past, has been the largest lead producer in the State, and one of the largest silver producers. The annual production of lead for a five-year period has averaged between 45,000,000 and 50,000,000 lb., and of silver, about 650,000 oz. The recent advances in the prices of these metals has assured the company a fair comfortable profit on its 528,000 shares. Last April, owing to unsettled metal market conditions, operations were suspended. During the summer, a force of from 60 to 100 men was kept on development work, the results of which are highly gratifying to the management. At the present time, about 200 tons of ore are being shipped to the smelter daily, and with the new and enlarged hoist, together with betterments for the more efficient handling of ore from all levels through the installation of pockets and better dumping facilities, production can be pushed up to 1000 tons per day. The management hopes to have it up to 500 tons per day before the snow flies. At present the company has about 300 men, but could use twice that number. Efficient miners are scarce at all mines here.

It is reported that the Jesse Knight interests of Provo recently closed a deal for the purchase of the Black Diamond group of ten claims adjoining the Bingham-Empire holdings at Bingham, and lying immediately south of the Bingham-Tooele group, thus giving them 2000 acres of promising mining ground. The Bingham Empire property has been owned by the Knight interests for a number of years, but very little work has been done for some time. It is reported that the Knights intend to explore the property with diamond-drills and to start an extensive development campaign to determine its value as a mining project. The ground is in the immediate vicinity of the Utah Metal & Tunnel and is thought to have excellent possibilities.

BRITISH COLUMBIA

WORK AT COPPER MOUNTAIN.—DISCOVERY AT COTTONWOOD CREEK.

PRINCETON.—An outline of what has been done and what is planned by the Canada Copper Co. in the development of the large low-grade orebodies of Copper Mountain, was given recently by H. R. Van Wagenen, general manager for the company, before representatives of the Boards of Trade of Vancouver and Princeton. Describing the ore of the company's new property as being not dissimilar to that of the Hidden Creek mine, Anyox, and of the Britannia Mine, Howe Sound, Mr. Van Wagenen said that all the plant and equipment essential in the economical treatment of such low-grade ore had been provided. A spur railway had been constructed connecting the mine with the Kettle Valley Railway Co. and the West Kootenay Power & Light Co. was to put in a line for the transmission of power for operation. Labor conditions had interfered with the construction of the railroad, but it now was well under way and as soon as completed the recovery of ore would be started. The power-line came in over 105 miles from Greenwood and 165 miles from Bonnington Falls, the source of the power. The necessary equipment was on hand for the mill to be operated at Allenby. The site of this plant was 5.5 miles from the town of Princeton and 7.7 miles from the mine. Mill construction would mean an investment of about $1,000,000 and the installation would permit the handling of 2000 tons of ore per day. Units were prepared in such a manner that a daily treatment of 5000 tons could be arranged for with little additional expense. Already the company, in preparation for the opening and the placing of its mine on a productive basis, had spent some $2,500,000, and there was no doubt that the aggregate investment, before all work was complete, would run to $3,500,000. With the outlay of the Kettle Valley Ry. Co. and that of the West Kootenay Power & Light Co. the investment, when the enterprise was in shape to commence making returns, would aggregate approximately $6,000,000. At the mine employment would be found for between 400 and 450 men. These, with their families, for whom houses were to be built, would constitute a new town of about 700 people. At Allenby the mill would require from 100 to 150 men. As a rule

mill men stayed steadily in one place, settling down with their families, so that it might be expected that this would mean another town of some 400 inhabitants. Copper products, at the present market, would amount to about $18,000 per day. There was a tonnage of 10,000,000 in sight, with an additional 2,000,000 semi-proved, added to which there would be ore at depth. The ore could be dealt with on the gravity system as the tracks and tunnels were below the lowest known ore. This ore would be run down to the mill and the resultant product

TRUNK PASS, NORTH-WEST KOOTENAY, BRITISH COLUMBIA

probably would be sent to the Trail smelter of the Consolidated Mining & Smelting Company.

TRAIL.—An appeal was argued recently before the Supreme Court of Canada which is of interest to the mining men of this Province, the principals being the Consolidated Mining & Smelting Co. of Canada and Endersy, a farmer in the Trail smelter district. This action was brought by Endersy against the company for damages claimed to have been done to his farm, crops, and timber by the smoke from the Trail smelter. The case originally was tried before a special jury which found for the plaintiff, the verdict awarding the latter $2170. The company appealed to the British Columbia Court of Appeals, which upheld the judgment of the lower court. The case then was carried to the highest Canadian court with the same result, the appeal being dismissed with costs.

CARIBOO.—A cable advice states that the Privy Council has given a verdict in favor of R. T. Ward in the case of Hopp v. Ward, thus giving the Bullion mine and equipment, near Quesnel Forks, to Ward. The placer property, consisting of 1200 acres, was originally taken up by Van Horn, Shaughnessy, Matthews, Osler, and other C. P. R. officials, who spent $3,500,000 in development and equipment. In 1906 the syndicate sold the property to the Guggenheims, who incorporated the Cariboo Gold Mining Co., which spent over $500,000 in further development and equipment. There are over 50 miles of canals and a number of dams and reservoirs on the property. In 1913 the company sold to R. T. Ward, of California, and ten days after Ward took possession the property was 'jumped' by John Hopp, on the technical ground that under the Mining Act it had been abandoned as a miner's license had not been renewed. Hopp applied for and obtained eleven leases, covering all the improvements. The case came up before the executive council twice in 1916, and a decision was given in favor of Hopp. The Quesnel Forks Gold Mining Co. was formed and took over the property. Ward took the case to the Supreme Court, which decided against him, but the decision was reversed in the Court of Appeal. The Hopp interests took the case to the Privy Council, which decided in favor of Ward. The litigation has cost Ward $15,000, only about a sixth of which he expects to recover from the losers.

VICTORIA.—W. M. Brewer, resident engineer for the district, who has been examining the mines in the vicinity of Cowichan lake, Vancouver island, reports the discovery of ore having a total value of $105 per ton on the Service property at Cottonwood Creek. The Consolidated company has sent an engineer to examine the property with a view to bonding it. A 50-ft. shaft has been sunk on the Lenora property by G. B. D. Turner, of Butte, and New York associates. Mr. Lavensaller and associates are developing a belt of schist carrying low-grade copper ore on Mount Brenton, on the opposite side of the river to the Lenora mine. The company is applying for the water right of the whole of the Chemainus river. Hill 60, the property of British Columbia Manganese Co., is developing well, and making regular shipments to Tacoma, where the ore is used for the manufacture of ferro-manganese. A number of discoveries of magnetite are reported.

ONTARIO

COBALT, PORCUPINE, KIRKLAND LAKE.

COBALT.—During the week ended October 17 shipments of ore amounted approximately to 1,164,505 lb., of which 729,645 lb. was from the Nipissing. This was the highest weekly shipment from that mine for several months. Litigation involving the ownership of the Bailey mine, which has been in progress for over five years, has been terminated by the acceptance of an offer by A. J. Young to purchase the assets and merge them with those of the Northern Customs Concentrator in a new company, to be known as the Bailey-Northern Customs, Ltd. The Bailey shareholders will receive stock in the new concern in exchange for their present shares. At the Beaver a vein 9 in. wide reported to carry 4500 oz. per ton has been encountered on the second level, and a 2-in.

vein of equal grade has been struck on the sixth level. The ore, in both cases is good milling ore. An official statement as to the result of exploration work on the Gans property of the Temiskaming mine is to the effect that the 3-in. vein occurring above the 500-ft. level is of uncertain character, showing patches of rich ore alternating with barren parts. A body of good milling-ore has been encountered in the older workings at the south end of the 575-ft. level. The Kerr Lake during September produced over 60,000 oz. of silver, indicating a quick recovery from the effects of the strike.

On October 16 the Prince of Wales visited Cobalt and received a most enthusiastic welcome, the whole population turning out to greet him. He inspected the Coniagas, O'Brien, McKinley-Darragh, and Kerr Lake mines, and the refinery of the Mining Corporation of Canada.

Porcupine.—At the Davidson four shafts are down. Two on the original property have reached a depth of 600 and 300 ft. respectively, and one of the properties recently acquired has a shaft down 130 ft., a cross-cut from which has opened up a good orebody. A small test-mill is treating development ore with satisfactory results. The big orebody at the 500-ft. level has been driven on for a considerable distance. The Boyce group of claims, comprising 160 acres adjoining the Hollinger Consolidated on the East, has been secured by Toronto, Hamilton, and Montreal capitalists, who will form a company to be known as the Gold Centre Mines, Ltd., capitalized at $3,000,000. At the outset 5000 ft. of diamond-drilling will be undertaken to cut the veins at a depth of about 500 ft. at several points where geological maps indicate a contact between the quartz-porphyry and the Keewatin. B. M. Walton has been appointed manager. The Northwoods Mining Co. of New York, which has 53 claims in Tisdale township, has done 1200 ft. of diamond-drilling with a view to cutting the vein system of the Hollinger; it is understood that the results have been satisfactory and that development will be undertaken. C. B. Morgan is in charge.

Kirkland Lake.—The miners strike was called off on the 15th and the men have returned to work. The Lake Shore has secured a sufficient force to operate at full capacity. The Teck Hughes has employed a large number and will shortly be in a position to equal or surpass its previous record. The situation generally is satisfactory and encouraging.

SONORA

NEW ROAD TO PROGRESSO—GOOD ORE DISCOVERED ON THE SANTANA

El Progresso.—El Progresso Silver company has completed a trucking road from its property 100 miles south of Nacozari to the Nacozari railroad and hereafter will ship over that line to Douglas, instead of over the Southern Pacific, through Nogales. A fleet of trucks owned by the company will be used to haul supplies to the mine and the concentrate and cyanide precipitates to the railroad. The concentrates are sent to the El Paso smelter while the precipitates are expressed to Perth Amboy, New Jersey, for refining. The company's new 100-ton mill went into operation the latter part of October. The ores of the property are highly silicious, and contain silver and gold. Both concentrating and cyaniding are in use. The average tenor of the ore in silver and gold is about $30 per ton. The mill recovers approximately 90%. The property is being operated through two shafts; the old shaft has been sunk to a depth of 200 ft. with drifts on the 100 and 200-ft. levels. On both levels continuous ore-shoots, the limits of which have not been determined, have been opened. About 50,000 tons of ore has been blocked out. The new double-compartment shaft, equipped at the surface with a large steam-hoist, head-frame, and cage, has been sunk about 100 ft. It will be carried to a depth of about 500 ft. to explore the property. Drifts will be run at 100-ft. intervals into the territory where ore has been proved by the old shaft and workings driven on the veins to develop the orebodies. Ore from the various dumps now is hoisted to the crusher levels by means of an incline track. The collar of the new shaft is on a level with the crusher floor of the mill and ore will be trammed by hand 200 ft. to the mill. The property is surrounded by a plentiful supply of wood for fuel and timber, while an abundance of water has been developed for use in mine, mill, and for domestic purposes. El Progresso is under management of A. Macfarlane, assisted by five American department heads. Approximately 150 Mexicans are employed in the mine and mill. The nearest town is Batuc, Sonora. Labor conditions in the vicinity of the property are ideal at present.

Mina Mexico.—The Mina Mexico, a silver property from which much high-grade has been shipped in the past, but for the last three years closed down because of revolutionary troubles, is expected to re-open in the near future. Chicago interests own this property. It is equipped with a mill and small smelter. The Mina Mexico lies in the foothills on the Sonora side of the Sierra Madre mountains, about 40 miles east of Batuc.

Santana.—A rich discovery of silver ore was made here recently by James V. Fryer, who is operating the Santana with a small force under lease from N. S. Finch. While driving a tunnel to get under old Spanish workings, an orebody was encountered, the extent of which has not yet been determined, but the richness of which cannot be doubted. The Santana, which lies near the San Nicolas mine in the southern part of the Moctezuma mining district, is an 'antigua', giving evidence of having yielded ore in the days of the 'Conquistadores' of Spain. Shallow workings and the remains of arastras in which the Spanish padres reduced the ore, still exist. The main vein, which is believed to have been uncovered by Mr. Fryer, was covered, it is believed by design, by the former exploiters of the ground. Mr. Finch is not at present in Sonora, being at Deming, New Mexico, making arrangements to start operations on silver properties in the vicinity of Kingston and Lake Valley, formerly large producers but closed down since the price of silver fell in the early '90's.

ARIZONA

Gunsight. Jones, Greer, and Meyers of Miami have leased the 17 claims of the Yellow Aster Mining Co. It is the intention of the lessees to sub-lease some of the claims. A drift has been started in No. 6 shaft to connect with shaft No. 7, a distance of 300 ft. A cyanide plant is to be built. The Gunsight Gold & Tungsten Milling Co.'s mill, which was recently damaged by a cloudburst, is undergoing repairs. This company is also installing improvements to handle the increased tonnage of custom ore of the district. The company now has a lease on the old Gunsight well which will ensure an ample supply of water. Arrangements have been completed for sinking a 100-ft. shaft and some driving on the B. B. Extension property. This is a gold property.

Kingman.—The Catherine mine, situated 40 miles west of Kingman, in the Union Pass district has opened a large tonnage of high-grade gold ore on recent development. The shaft is now down 400 ft. and cross-cuts are being driven on the 300 and 400-ft. levels to prospect the vein upon which 300 ft. of driving has been done on the 200-ft. level. On this level it is claimed that 12 ft. of $30 ore has been opened. E. C. Bradshaw has taken an option on the Diamond Joe mine. A considerable tonnage of ore is developed in the mine. The mine and dump ores are to be hauled to the Arizona Molybdenum mill for treatment, two miles away. The Dean mine, situated 15 miles east of Kingman, has been purchased by St. Louis interests. Captain Gibson, who is to be in charge of the property, contemplates the immediate erection of a mill to treat the 20,000 tons of ore at present developed. The shaft of the Senate silver property, which adjoins the Hackberry, is now down 200 ft. Since the first of the year mine buildings, compressor, gas engines, and hoist have been installed, sinking having commenced in July.

Prescott.—It is reported that the Philadelphia Mining Co.'s 3000-ft. tunnel has penetrated the orebody 700 ft. below the workings of the old 80-ft. shaft. The vein is 5 ft. wide and carries principally gold. A raise is to be started immediately to connect the old shaft. Development work has been under way for four years under the direction of G. P. Harrington.

G. M. Spicer and Associates of Los Angeles are reviving the old Perry silver mine of the Gold Blossom Mining Co., nine miles south of Prescott on the Hassayampa river. This property was prominent in the 'eighties, being a shipper to Colorado.

Tucson.—The southern part of the Amole district is the most active area in that district. Operations are being pushed both at the Arizona-Tonopah Mining & Milling Co.'s property and the Arizona-Tucson Copper Co.'s prospect. These properties adjoin the old Saginaw property on the east; this latter property was worked with success in the 'nineties. Since the first of the year the Arizona-Tonopah has installed power-house, dwellings, and the necessary power equipment for sinking the 9 by 4-ft. shaft to the 200-ft. level, at which point it is the intention of the management to cross-cut. The shaft is at present 73 ft. deep. Another prospect shaft is being sunk 1500 ft. north-west of the main shaft. This shaft passed through ore running 17 oz. in silver. The Arizona-Tucson Copper Co. is completing dwellings, mine buildings, installing a 20-hp. distillate engine for power and a 60-hp. Fairbanks-Morse crude-oil engine hoist. The new vertical shaft is down 30 ft. and sinking will be resumed on the completion of the head-frame and machinery installation. Over 200 tons of high-grade copper ore running high in gold and silver is now on the dump. This ore was taken from a small glory-hole at the surface near the old discovery shaft.

CALIFORNIA

Amador City.—The restraining dam of the Keystone Mines Co., spanning Amador creek, is being raised 20 ft., giving the restraining pond an additional storage capacity of approximately 1,500,000 tons. Operation of the mill has ceased pending improvement to the barrier, as sand has been flowing over the dam.

Downieville.—The main channel has been opened in the Wehe drift mine on St. Charles hill by a raise from the tunnel. Much water is present and a second raise is being driven to drain the channel. The gravel is good grade and will be mined through No. 1 raise.—Preparations are being made for extensive work at the Kate Hardy, formerly a good yielder of quartz-gold. The property lies on Oregon creek and is controlled by Will M. Beggs of San Jose.

Knob.—An orebody believed to be the Lucky Baldwin vein has been uncovered in the Midas mine of the Victor Power & Development Co. The vein is about 8 in. wide and shows high-grade ore. Four Gibson mills are running on ore from the Midas and Bull Moose properties of the Victor holdings.

Ono.—Arbuckle Mining Co. is adding five stamps to the five-stamp mill and preparing erection of several buildings. A road 4½ miles long is under construction to the mine from the highway. The property, known locally as the Bell Cow, is attracting considerable attention as the result of discoveries of excellent mill ore.

Placerville.—H. G. Fairchild and R. Richards have begun operations at the Roundout gravel property, four miles north-east of Placerville. The property is equipped with an excellent plant, and deep gravel deposits are demonstrated. Considerable development work was performed last spring.

COLORADO

Silverton.—The following is the agreement and wage-scale that has been adopted by the Silverton Miners Union No. 26 and the mine operators of San Juan county. This is in force from September 1, 1919, to September 1, 1920.

1. Eight hours shall constitute a day's labor in and about mines, mills, smelters, and tramways.
2. Time and a half to be paid for overtime.
3. $4.75 shall constitute a minimum day's wage.
4. For all classes of labor working in wet places where rubber clothing is required 50c. additional shall be added.
5. For sinking and raising 50c. additional shall be added.
6. Miners Union secretary to be allowed to go to the different mines to collect dues.
7. Pay-day twice a month.

* This scale shall be based on $1.25 per day board.

MINE.	
Miners	$5.25
Machinemen	5,50
" helpers	5.00
Timbermen	5.50
" helpers	4.75
Engineers	5.50
Repair and pipemen	5.50
Blacksmiths	6.00
" helpers	5.00
Machinists	6.00
" helpers	5.00
Blasters	5.00
Firemen	5.00
Station tenders	4.75
Mule drivers	4.75
Shovelers	4.75
Ore sorters	4.75
Roustabouts	4.75
Electricians' helpers	5.25
Nippers	4.75
Trammers	4.75
TRAMWAY	
Linemen	6.00
Gripmen	5.00
Bucketmen	5.00
Brakemen	5.00
MILL	
Battery-men	5.75
" helpers	5.00
Repair-men	5.75
" helpers	5.25
Oil flotation men	5.25
Huntington and Chilean-men	5.00
Jig-men	5.00
Table-men	5.00
Ball and pebble-men	5.00
Filter-men	5.00
Crusher-men	4.75
Samplers	4.75
Mud-pullers	4.75
Oilers	4.75
Roustabouts	4.75

NEVADA

Carson City.—Comstock Superior Co. reports discovery of a 10-ft. vein of $23 silver ore 75 ft. from portal of tunnel. It is a blind vein and occurs at a depth of 50 ft. Tunnel driving continues in order to reach an orebody 30 ft. distant that assays $40 per ton in silver and gold at surface. G. S. Clark, the manager, states that nine distinct veins occur on the property.——Another high-grade shoot sampling $301 per ton has been intersected at a depth of 72 ft. in the Southwest Comstock Extension. It is 2 ft. wide. Thurman Roberts is superintendent.——Erection of foundations for an electric hoist and 75-hp. compressor is proceeding at the Mighels group, operated by Nevada Protective Mining & Investment Co. E. R. Argersinger, the manager, states a 400-ft. vertical shaft will be sunk and drifts extended to known veins. San Francisco and Oakland people are chiefly interested.

National.—The Forrest Bell lease on Buckskin National has uncovered high-grade gold-silver ore, according to the management. The [illegible] assays $20 to $50 per pound and a shipment, estimated at $1400 per ton, has been made to a customs smelter. W. I. Bell, the manager of the parent company, states 3500 ft. of development work has been accomplished, including a 400-ft. shaft. Good ore has been exposed at many points, with several leasing companies prepared for production.

Personal

The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

D. C. Jackling is in New York.

Gilmour E. Brown is in Scotland.

Samuel Newhouse is at Salt Lake City, from New York.

J. M. Callow has returned from New York to Salt Lake City.

H. F. Bain is in the Malay States, inspecting alluvial tin mines.

D. W. Leeke has returned from Korea and Japan, on his way to Mexico.

Wilton Shellshear has returned from Tezuitlan, Mexico, to San Francisco.

Charles T. Hutchinson, business manager for the 'M. & S. P.', has returned from New York to San Francisco.

Olaf P. Jenkins has resigned from the Arizona Bureau of Mines to undertake geological work in foreign countries.

F. W. Bradley has returned from Alaska. On his way back, he visited the Bunker Hill mine, at Kellogg, Idaho.

Edward H. Watson, manager for the Olekma & Vitim Gold Syndicate, passed through San Francisco on his way from Siberia to London.

Victor C. Heikes and **B. S. Butler,** of the U. S. Geological Survey, were recently at the Tintic Standard mine in East Tintic district, Utah.

T. M. Daulton, general manager for the Placer Gold Mines Co., at Atlin, B. C., has gone to Manila, P. I., to exploit some placer deposits.

Henry S. Lyne has accepted the position of mill superintendent for the Iron Mountain Limited lead-silver-zinc properties, at Salmo, British Columbia.

Louis A. Wright sailed on the 'Canopic' for Italy from New York on October 22, to take up professional work; his address will be Parlamento 22, Rome.

Thomas F. Donnelly left New York on October 20 for South America, where he will examine properties in Chile, Bolivia, Peru, and Brazil. He will be gone about eight months.

R. C. Gemmell, assistant managing director of the Jackling copper enterprises, has returned to Salt Lake City after inspecting the Ray and Chino properties in company with **D. C. Jackling.**

George W. Starr has been elected president of the California Metal Producers Association. **Edwin Higgins** was selected as delegate of the Association to the convention of the American Mining Congress.

C. B. Lakenan, general manager for the Nevada Consolidated Copper Co. at McGill, Nevada, was at Salt Lake City on October 20. On the 21st he left for Chicago, accompanied by **E. W. Engelmann,** on company business.

Clarence E. Allen, general manager of the Utah Department of the United States S., R. & M. Co., has returned from Eureka, Nevada, where he went to inspect the development work being done by the Eureka-Croesus company.

R. T. Walker has resigned as superintendent of the Virginia-Louise Mining Co. at Ploche, Nevada, to accept the position of manager of the Ore Purchasing Department of the United States S., R. & M. Co., at Salt Lake City, Utah.

Edward W. Berry and **Joseph T. Singewald, Jr.,** professors of geology in the Johns Hopkins University, have returned from their six months geologic studies in Peru, Bolivia, and Chile, which were conducted through the George Huntington Williams Memorial fund.

THE METAL MARKET

METAL PRICES

[illegible]

Aluminum, 99 per cent. pure, per pound 60
Antimony, cents per pound 9 00
Copper, electrolytic, cents per pound ..... 18 00—18 62½
Lead, 100 cents per pound 8 40
Platinum, pure, per ounce $140
Platinum, 10% iridium, per ounce $160
Quicksilver, per flask of 76 lb. 88 00
Spelter, cents per pound 9 00
Zinc dust, cents per pound ..... 11 00—13 50

EASTERN METAL MARKET

(By wire from New York)

[illegible]

Zinc is dull and unchanged.

SILVER

Below are given official or bidder quotations in cents per ounce of silver 999 fine. From August 23, 1918, the United States Government paid $1 per ounce for all silver purchased by it. Prior to enactment of $1 01½ on August 15, 1918, and was entitled to the $1 until the monthly specified under the Act is purchased, probably extending over several years. On May 5, 1919, the purchases of the metal from producers ceased pending its fluctuations. During the restricted period, the British government fixed the maximum price five times, the last being on March 25, 1919, on account of the low rate of sterling exchange, but removed all restrictions on May 10. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the normal rate of exchange.

Date		New York cents	London pence			Average week ending Cents	Pence
Oct	22	120 12	64 75	Sept.	16..	.112.77	61 14
	23	118 50	63 87		23..	.114 10	62 04
	24	....118 75	64 00		30..	.117 70	63 14
	25	....118 87	64 50	Oct	7..	.119 56	63 71
	26	Sunday			14..	.117 44	62 83
	27	.....119 50	64 00		21..	.117 95	63 98
	28	.....120 75	65.37		28..	.119 37	64 45

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	...75 14	88 72	101 12	July	. 78 92	99 62	106 36
Feb.	...77 54	88 79	101.12	Aug.	. 85 40	100 31	111 35
Mch.	...74 13	88 11	101 12	Sept.	.100 73	101 12	113.92
Apr.	...72 51	99 35	101 12	Oct	. 87 38	101 12	....
May	. 74 01	99 50	107 23	Nov.	. 85 97	101 12	....
June	. 76 44	99 50	110 50	Dec	. 85 97	101 12	....

COPPER

Prices of electrolytic in New York, in cents per pound

Date			Average week ending		
Oct	22	.21 75	Sept	16	22 29
	23	.21 75		23	22 10
	24	.21 75		30	21 58
	25	.21 75	Oct	7	21 35
	26	Sunday		14	21 72
	27	.21.75		21	21 87
	28	.21 75		28	21.75

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan	....29.53	23 50	20 43	July	2[illegible]	26 00	20 82
Feb	....34 57	23 50	17 34	Aug	27 42	26 00	22 51
Mch	....36 00	23 50	15 05	Sept.	.....25 11	26 00	22.10
Apr	....33 16	23 50	15 23	Oct.	.....23 50	26 00	....
May	... 31 69	23 50	15 91	Nov.	.....23 50	26 00	....
June	.....32 57	23 50	17 53	Dec	..23 50	26 00	....

LEAD

Lead is quoted in cents per pound, New York delivery

Date			Average week ending		
Oct	22	6 50	Sept	16	5.97
	23	6 50		23	6 20
	24	6 75		30	6 07
	25	6 75	Oct.	7	6 16
	26	Sunday		14	6 25
	27	6 75		21	6 43
	28	6 75		28	6 66

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan	..... 7 64	6 85	5 60	July	.....10 93	8 03	5 53
Feb	..... 9 10	7 07	5 18	Aug.	.....10.75	8 05	5 78
Mch	.....10 07	7 28	5 24	Sept.	..... 9 07	8 05	6 02
Apr	..... 9 38	6 99	5 05	Oct	..... 6 97	8 05	....
May	.....10 29	6 88	5 04	Nov.	..... 6 38	8 05	....
June	.....11 74	7 59	5 32	Dec	..... 6 49	6 90	....

TIN

Prices in New York, in cents per pound:

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan	.....44 10	85.13	71.50	July	.....62 60	93 00	70 11
Feb.	.....51 47	85 00	72.44	Aug.	.....62 53	91 33	62.20
Mch.	.....54 27	85 00	72.50	Sept.	.....61 54	80 40	55 79
Apr.	.....55 63	88 53	72.50	Oct.	.....62 24	78 82	....
May	.....63.21	100.01	72.50	Nov.	.....74 18	73.67	....
June	.....61.93	91.00	71.83	Dec.	.....85.00	71 52	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound

Date			Average week ending		
June					
Oct	22	8 10	Sept	16	7 50
	23	8 10		23	7 38
	24	8 10		30	7 72
	25	8 10	Oct	7	7 89
	26	Sunday		14	8 10
	27	8 10		21	
	28	8 10		28	

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	..... 9.75	7.78	7 44	July	8 98	8.72	7.78
Feb.	.....10.45	7 97	6 71	Aug.	8 58	8 78	7 81
Mch.	.....10 78	7 67	6 63	Sept.	8 33	9 58	7 57
Apr.	.....10.20	7 04	6 40	Oct.	8 32	9 11	
May	..... 9 41	7 92	6 43	Nov.	7 76	8 [illegible]	
June	..... 9 03	7.92	6 91	Dec.	7 84	8 49	

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. Prices, in dollars per flask of 75 pounds:

Date					
Sept.	30	105 00	Oct	14	[illegible]
Oct.	7	[illegible]		21	[illegible]
				28	[illegible]

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	$84 00	128 00	103.75	July	.....102 00	120 00	100 00
Feb.	.....126 25	118 00	90.00	Aug.	.....115 00	120 00	103 00
Mch.	.....113 75	112.00	72 80	Sept.	...112 00	120 00	102 60
Apr.	.....114 50	115 00	73 12	Oct.	...102 00	120 00	86.00
May	.....104.00	110 00	84 80	Nov	....102.50	120 00	....
June	..... 85 50	112 00	94 40	Dec.	.....117.42	115 00	....

MONEY AND EXCHANGE

A recent event of importance was the [illegible] for shipment of a new $[illegible],000,000 bond issue on this side, about half of which was to be available as a [illegible] Bankers' credit before May 1, the amount thus may not seem a very potent factor in relation to the complexities of the whole exchange problem, but the sentimental and psychological influence is considerable. The same influences are contributing to hopes of further financing to help the French credit.

The British credit now [illegible] is a virtual [illegible] on sterling exchange through the [illegible] of conversion into war bonds at a fixed rate of $4 40 for the pound. Sale of war bonds at par would realize amounts varying from par at the rate fixed to as high as 113 19 should exchange recover to its own par of 4 86. Head to maturity the bond would cost [illegible] at the fixed rate to 118 85 with sterling back to parity. As the new loan will not carry about $11[illegible],000,000 new money its effect outside [illegible] market that action. Its significance is perhaps chiefly that of a precursor of general improvement to come in the exchange situation as the [illegible] tion draws nearer, and a wider emphasis is put on the theme of credit extension. The latest principles of Mr Lamont the [illegible] at Atlantic City, [illegible] and the reporting of the Edge bill to the House, with favorable action likely next week, are all straws in this direction.

Reporting to the Investment Bankers' Association convention at St. Louis, Thomas W. Lamont of J. P. Morgan & Co., chairman of the foreign [illegible] committee, referring to the foreign credit said it had [illegible] again said it [illegible] as to necessity of extending credit to European countries, but few steps have been taken in this [illegible]. Extension of credit abroad implies purchase of foreign securities, government, [illegible] or both, by American investors. As a whole this question has not yet [illegible] to the necessity of extending credit to maintain American export trade. We [illegible] grasp of the necessity of extending credits to Europe in order to [illegible] general [illegible] the necessity of extending credits to Europe in order to [illegible] general [illegible] customers who, in the past five years, have, together with other foreign markets, bought $[illegible],000,000 worth of products from America.

We then straightway forget all about it. Passing the buck is the [illegible] phrase that describes the situation. Some say — Let the bankers extend the credit,' as if bankers, who must return on demand the money deposited with them, had any right to tie that money up in long-term loans. Other people seem to think extending credit to Europe is purely a technical matter, having to do with Wall Street or foreign exchange.

Extension of credit [illegible] to Europe is a work for every thrifty and solvent citizen of the United States. If we don t do our share, nobody else will. Europe wants to buy wheat. Our farmers have wheat to sell. The farmers must [illegible] that wheat on credit, but all on credit, but a reasonable share. The farmer will extend that credit, but as to a [illegible] shipment of 100 bushels, but through investing in a thousand dollar bond of some solvent European country that may offer her promise to pay for sale here, so that with the credit she establishes her people can buy American wheat. The same applies to all manufacturers, to all merchants. If Europe is to be fed and clothed, to continue the excellent customer she has been, we must all get into the same co-operative frame of mind."

Quotations on October 28 are as follows:

Sterling	Cable	4 18 [illegible]
	Demand	4 17 [illegible]
Francs	Cable	8 58
	Demand	8 60
Lire	Demand	10 56
Marks		3 40

Eastern Metal Market

New York, October 22.

The markets are more active except for copper, and prices have advanced in most cases, copper being the only metal that has reacted.

Buying of copper has fallen off again, after fairly good buying due to a reduction in prices by the large producers, which satisfied present needs.

Spot tin has advanced, as well as tin ex-steamer at docks, because of the longshoremen's strike in New York harbors.

The lead market is active and higher, the leading interest having advanced its price.

Demand for zinc for export via Gulf ports is active and prices are higher in general.

Antimony is a little stronger.

IRON AND STEEL

Production has increased in both pig-iron and steel the past week and the steel output is now up to a 60% basis, full operation being practically recorded in the Pittsburgh district and eastern Pennsylvania. The scarcity of common labor is a drawback even in the Pittsburgh district. Consumers are not pressing for steel, but as the strike comes to a close premium offerings are expected. Sales of malleable iron are the leading features in the pig-iron market. For 22,000 tons of plates for the Navy, the leading Pittsburgh producer bid 2.50c. per lb. and 2.40c. on 6800 tons of structural shapes, but 2.65c. and 2.45c. continue the ruling prices on these products. An Eastern mill has advanced its price ½c. per lb. on alloy steel bars and $15 per ton on alloy steel billets. October business in fabricated steel has fallen off sharply.

COPPER

The situation in this market is a complex one and has undergone quite a change in the week. Late last week the large producers of electrolytic copper, who have steadily and finally held their price at 23.50c., New York, for many weeks, reduced their quotations—at least one or two of them did. The result is understood to have been that several did a fair business at levels considerably under this and that most of the rest followed suit. As a result today it is said that most of them are quoting about 22c. for electrolytic for early or last quarter delivery. The outside market, which had advanced a week ago to 22c. to 22.50c., is now relatively lower or around 21.50c., New York. This market may be quoted conservatively at around 21.75c., New York, for electrolytic and 22.25c. for Lake, with demand light. The fairly good buying a week ago has apparently cleaned up most outside lots and satisfied the present needs. Consumers are marking time, due to the sudden change in front of the large producers, and very little buying is just now in evidence.

TIN

As a whole the tin market has been a quiet one the last week. Most of the business done has been in prompt metal out of store at stiff premiums. Spot Straits, New York, has sold as high as 56.50c., which we quote as the market. The next most active position has been from steamers now at dock, the tin not being available in most cases because of the longshoremen's strike. This metal has sold up to 56.50c. There has been an active demand for prompt tin, which at the closing on Monday was 56.75c. to 57c. asked. Tin ex-steamer Mesaba sold as high as 55c., with 55.50c. asked at the close Monday. There has also been a fair business in metal for prompt shipment from London with prices up to 54c. For November-December shipment from the Far East some business is reported at 53.75c. This low level was attractive to some buyers. Last Monday was the most active day of the past seven or eight days. The presence of United States troops at the docks and in New York may affect the present tense situation so as to force down the price of prompt tin ex-store and advance that of tin ex-steamer at dock. American 99% tin sold at 54.50c. last week and 55.25c. is now asked. American pure tin is quoted from one source at 55.50c. Tin arrivals to date are reported to have been 5265 tons, of which only 100 tons has come in at Pacific ports. There are 5105 tons reported afloat. The London market is firm with spot Straits quoted at £281 5s. per ton.

LEAD

Demand has been good and also greater than the supply. On October 16 the American Smelting & Refining Co. advanced its price from 6.25c. to 6.50c., New York, but this was not generally known until the next day, October 17. Previous to this the outside market had nearly reached the higher level. The advance by the leading producer was not entirely unexpected. The higher prices are largely the result of inability of consumers to get their lead because of strikes which have resulted in some competitive bidding for that available. Spot lead has been sold at New York up to 6.60c. Some business has been done since the advance at 6.25c., St. Louis, and more could have been done had there been sellers. The shortage in production, due also to strikes, and the scant supplies, have resulted in a very strong market, which we quote at 6.25c., St. Louis, and 6.50c., New York.

ZINC

The market has continued to advance, due largely to a fairly good export demand and a higher British market, which has also been advancing. Inquiry from galvanizers is also said to be better. Prime Western for early delivery, 30 days, is quoted today at 7.75c., St. Louis, or 8.10c., New York. The export selling has been largely by Western producers, shipments to be made from Gulf ports.

ANTIMONY

The market is slightly stronger with wholesale lots for early delivery at 8.62½c., New York, duty paid.

ALUMINUM

Virgin metal, No. 1, 98 to 99% pure, is still available at 32c. to 33c., New York, for wholesale lots for early delivery.

ORES

Tungsten: A little domestic business is reported at around $7 for Chinese ore. For other grades quotations range as high as $10 to $12 per unit. A fair demand for export is recorded, some for British buyers and some for Central Europe. The unfavorable exchange rate is a factor against much business, but negotiations are proceeding. There does not seem to be any market for ferro-tungsten and actual prices are difficult to report.

Molybdenum: Quotations are nominal at 75c. per lb. of MoS_2 in regular concentrates, in the absence of any demand.

Manganese: Imports of high-grade ore in August were only 8246 gross tons, against a monthly average of 37,664 tons for the first half of 1919.

Manganese-Iron Alloys: Quotations are unchanged at $100 to $110 for ferro-manganese, depending on whether it is British or American alloy. About 10,000 tons of spiegeleisen has been sold to buyers from Holland and Belgium at $34 to $35, furnace. About 1000 tons has been sold for domestic consumption, with about 500 tons before the market.

Book Reviews

Industrial Electro-Metallurgy. By Eric K. Rideal. Pp. 236, ill., index. D. Van Nostrand Co., New York. For sale by 'Mining and Scientific Press,' San Francisco. Price, $3.

This book is one of a series planned to give a complete review of industrial chemistry. The principal commercial processes discussed are electro-plating and other electro-deposition of metals, and the manufacture in the electric furnace of iron, steel, the ferro-alloys, and various other metals, as well as carborundum and similar substances, and the nitrates, cyanides, and cyanimides. The book is suited to anyone with a knowledge of elementary chemistry, and will be of value to those who are interested in the electro-chemical industries.

Governors and the Governing of Prime Movers. By W. Trinks. Pp. 229, ill., index. D. Van Nostrand Co., New York. For sale by 'Mining and Scientific Press,' San Francisco. Price, $3.50.

This is probably the first complete treatise on the subject in English. The chapters have the following titles: The direct-control governor as a motor; The centrifugal governor as a measuring instrument; Promptness and traversing time; Adjustment of equilibrium-speed; Shaft-governors; Natural period of vibration for governors; Effects of outside forces; Inter-action between governor and prime-mover; Discarded types of speed-governors; Rate-of-flow governors; Pressure governors; and Governor troubles. The book will be of value to those engaged in the design of prime-movers and also to those having oversight of their operation. An appendix contains a complete bibliography.

Steam Turbines. By J. A. Moyer. Pp. 488, ill., index. John Wiley & Sons, Inc., New York. For sale by 'Mining and Scientific Press,' San Francisco. Price, $4.

This useful treatise, originally issued in 1908, has been revised and enlarged for the fourth edition, taking full account of the recent advances in steam-turbine design. The general theory of steam-turbines is developed in several chapters on thermo-dynamics, nozzle and blade design, and the mechanical losses in turbines. The various commercial types of turbines in use at the present time are then discussed. Then follow several chapters on special types, including low-pressure and mixed-pressure turbines, extraction turbines, and marine turbines. Then come chapters, respectively, on steam-turbine economics, and on stresses in various parts of the turbine. Another chapter is devoted to gas-turbines. The book will be of value both to the designing engineer and the student.

Practical Mathematics for Home Study. Pp. 488, ill., index. McGraw-Hill Book Co., Inc., New York. For sale by 'Mining and Scientific Press,' San Francisco. Price, $4.

The author of this book is associate professor of mathematics at the Armour Institute of Technology and has taught evening classes at that institution for a number of years. The book includes in one volume the material he has already published in four separate volumes together with some additional matter. It discusses thoroughly arithmetic, algebra through and including quadratic equations, plane and solid geometry, plane trigonometry, and the elements of graphical representation. Every effort is made to associate in the student's mind the practical application with the theoretical basis. For instance, worm-gearing and the use of the micrometer are discussed under common fractions, hydraulic presses under ratio and proportion, and the cutting of rafters under the geometry of triangles. While the main purpose of the book is to satisfy the needs of the artisan, the mechanic, or the self-taught engineer that feels the need of supplementing his early education in mathematics, it may also be found useful by many technically trained men that wish to review their mathematics, and who have lost or otherwise disposed of their college text-books, and who may be pleased to find under one cover all or nearly all they need.

Techno-Chemical Receipt Book. By William T. Brannt and William H. Wahl. Henry Carey Baird & Co., Inc., New York. For sale by 'Mining and Scientific Press,' San Francisco. Price, $2.50.

This is a remarkable book containing several thousand receipts of all kinds. These are arranged alphabetically beginning with alloys, artificial gems, and bitters, and going right through the alphabet to waterproofing compounds, wood-polishing, and yeasts. To many that are now suffering from drought, the division on bitters, cordials, and elixirs should alone be worth the price of the book. Joking aside, however, the scope is so wide and the ground is covered so completely, that there are few people in any occupation that would not find a great deal in the book of both interest and value. As is especially necessary in a book of this kind, both the table of contents and the index are remarkably full, making its use for reference easy.

The Construction of Graphical Charts. By John B. Peddle. Pp. 155, ill., index. McGraw-Hill Book Co., Inc., New York. For sale by 'Mining and Scientific Press'. Price, $2.

The author is professor of machine design at Rose Polytechnic Institute, and the book, although on a sound theoretical basis, is written from the standpoint of the engineer rather than the mathematician. The first five chapters discuss the various kinds of charts in two dimensions, comprising those platted for rectangular co-ordinates, including logarithmic charts, alignment charts for three or more variables, hexagonal charts, and proportional charts. The next chapter is devoted to the derivation of empirical equations from points already platted on any kind of a chart. Following this is a discussion of stereographic charts and solid models, and the final chapter considers determinants and their use in the derivations of equations and formulas. The treatment of the various subjects is as simple as possible, and can be readily followed by anyone having a knowledge of elementary algebra. It will be useful both to the engineer and as a textbook for the student.

Heat and Heat-Engines. By Andrew Jamieson. Revised by Ewart S. Andrews. Volume I. Pp. 543, ill., index. Charles Griffin & Co., Ltd., London. For sale by 'Mining and Scientific Press,' San Francisco. Price, $3.

The eighteenth edition of the late Professor Jamieson's book on steam and steam-engines has been enlarged to two volumes and deals with internal-combustion as well as steam engines. Volume I is devoted entirely to the reciprocating engine, while Volume II will discuss steam-boilers, steam-turbines, and internal-combustion engines. The book has been thoroughly revised and brought up-to-date, at least from a British standpoint, although the American railroadman may be inclined to smile a little at the description of an especially heavy locomotive, weighing 108 tons with the tender, and with 1772 sq. ft. of heating surface. The 26 chapters of the book consider the development of the steam-engine from its earliest form, give the laws of heat as applied to its construction, and then discuss the various types of reciprocating engines now in use, together with pumps and other auxiliary machinery. The book is well illustrated. It will be of value as a text-book, although most American instructors will probably prefer some one of the other

standard books more directly related to American practice, which, while agreeing in the main points with British practice, nevertheless differ in details.

Recent Publications

Notes on the Lead Mines of Southeast Missouri. By F. B. Hyder. U. S. Bureau of Mines, July, 1919. Pp. 11.

Talc and Soapstone. Excerpts from Monthly Reports on Minerals Investigations of the U. S. Bureau of Mines, for August, 1919. Pp. 3.

Electrodeposition of Gold and Silver from Cyanide Solutions. By S. B. Christy. Bull. 150, U. S. Bureau of Mines, 1919. Pp. 171, ill., index.

Phosphate Rock in 1918. By Ralph W. Stone. II:9, U. S. Geological Survey, 1919. From Mineral Resources of the United States, 1918—Part II.

Magnesium in 1918. By Ralph W. Stone. I:2, U. S. Geological Survey, 1919. Pp. 9. From Mineral Resources of the United States, 1918—Part I.

Potash Recovery at Cement Plants. By Alfred W. G. Wilson, Ph.D. Bull 29, Canadian Department of Mines, Mines Branch, 1919. Pp. 34, ill.

Prices of Coal and Coke. By C. E. Lesher. W. I. B. Price Bull. 35, U. S. Geological Survey in co-operation with War Industries Board, 1919. Pp. 113.

The Magnesite Industry in Austria. Excerpts from Monthly Reports on Minerals Investigations of the U. S. Bureau of Mines, for August, 1919. Pp. 4.

Magnesite in 1918. By Charles G. Yale and Ralph W. Stone. II:7, U. S. Geological Survey, 1919. Pp. 18. From Mineral Resources of the United States, 1918—Part II.

Stone in 1917. By G. F. Loughlin and A. T. Coons. II: 30, U. S. Geological Survey, 1919. Pp. 68, index. From Mineral Resources of the United States, 1917—Part II.

Explosives and Miscellaneous Investigations. Bull. 178-D, U. S. Bureau of Mines, 1919. Pp. 19. Advance chapter from Bulletin 178, War Work of the Bureau of Mines.

Coke and By-Products in 1916 and 1917. By C. E. Lesher and W. T. Thom, Jr. II:34, U. S. Geological Survey, 1919. Pp. 65, table. From Mineral Resources of the United States, 1917—Part II.

Mineral Resources of Seward Peninsula, Alaska. Papers by George L. Harrington. Bull. 692-G, U. S. Geological Survey, 1919. Pp. 48, map. From Mineral Resources of Alaska, 1917-G.

The Sand and Gravel Resources of Missouri. By C. L. Dake. Vol. XV, Second Series, Missouri Bureau of Geology and Mines, Rolla, Missouri, 1918. Cloth bound. Pp. 274, ill., maps, index.

Petroleum Investigations and Production of Helium. By Van. H. Manning. Bull. 178C, U. S. Bureau of Mines, 1919. Pp. 25. Advance Chapter from Bull. 178, War Work of the Bureau of Mines.

A Reconnaissance of the Pine Creek District, Idaho. By Edward L. Jones, Jr. Bull. 710-A, U. S. Geological Survey, 1919. Pp. 36, map. From Contributions to Economic Geology, 1919—Part I.

The Salient Features of the Geology of Oregon. By Warren Dupre Smith and Earl L. Packard. University of Oregon Bulletin, Vol. 16, No. 7, July 1919. Pp. 42. University of Oregon, Eugene, Oregon.

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UNDER 'Discussion' we publish a reasonable protest against the low salaries paid to mining engineers. This comes to us from Mr. W. F. Dietrich, Associate Professor of Mining in Stanford University. His letter will be read, we feel sure, with interest and sympathy.

ON the very day the coal strike began, it was announced that a general meeting of miners and transport workers in the Rhine valley decided, owing to the lack of coal in Southern Germany, to re-establish the 12-hour day, with voluntary work on Sundays until the crisis is past. Give the devil his due; these Germans show a spirit in some things that is worthy of respect, and of imitation.

BRITISH COLUMBIA is a mining region in which American capital has been used to advantage; therefore our readers will be glad to read the account of the discovery of the Premier mine, in the Salmon River district. This account is attractive because it is the straightforward story of a man on the ground. Moreover, it is peculiarly timely because we are informed by our correspondent at Victoria that a sale of the control of the Premier mine has been negotiated with the American Smelting & Refining Company, the price for 51% being five million dollars.

ALTHOUGH the strike in the Tonopah district is supposed to be ended, it is a fact that the mines are short-handed because the alien element has aligned itself with the I. W. W., whereas the American and British miners are now working as members of the 'domestic' union started locally, in opposition to the radical and un-American group that is trying to subvert honest industry. The I. W. W. leaders have not hesitated to hold out the promise, to their alien following, of a six-hour day and then a four-hour day, with the deliberate intent finally not to work at all, but to enjoy the fruits of other men's labor under a red dispensation, resembling that of the Russian soviets.

SALTING is a subject that is of perennial interest; it appeals to the commercial instinct and also to the mining engineer's sense of humor, although it is fair to add that the victim of it is likely to smile on the wrong side of his face. Mr. Morton Webber discusses this important phase of mine examination from the background of a wide experience, not as a victim but as a successful baffler of "ways that are dark and tricks that are vain". He recognizes, however, that 'eternal vigilance is the price of safety', and he has shown the proper professional spirit in publishing his own method of prevention, so that others may benefit therefrom. This article will form one of a further series on the sampling of mines that we hope to publish from his pen.

LITIGATION extending over four years was ended on October 27 when the U. S. Circuit Court of Appeals in San Francisco dissolved the injunction and dismissed the receiver granted by the lower court in the matter of the Presidio Mining Company. Captain W. S. Overton, as a shareholder in the company, had brought charges of fraud against Mr. William S. Noyes, the president of the company, which owns a well-known silver mine in Texas. In rendering its decision the Court said: "In all these transactions we find no evidence of fraud or unfair conduct on the part of William S. Noyes in his dealings with the Presidio Mining Company or any of its stockholders and no assertion of a sinister influence over the board of directors or any of its stockholders." We take pleasure in giving prominence to this decision because many of our readers know and respect Mr. Noyes, and they have been aware of the unpleasant litigation arising from a dispute over the management of a mine the success of which has been due largely to his technical skill and business sagacity.

AT the final meeting of the leaders of the United Mine Workers of America, on which occasion it was decided that the coal strike should take place as planned, in defiance of the message of President Wilson, the leaders, according to press dispatches, "disapproved" of the tone the President used. Not one of them, we are informed, defended the President's message, but, on the contrary, they were unanimous that it was a mistake, being "more liable to irritate the miners than to mollify them". The absence of the sense of humor verges on criminality. The President's indictment of the impending strike did not impress us as being an attempt to "mollify" the recalcitrant miners. A mental equipment so devoid of humor as that manifested by these patronizing misleaders of labor may explain the lack of balance that impels them to attempt such an outrageous imposition on the American people. But it can't be done. However much they may be deficient in the sense of the eternal fitness of things, enough of that saving grace is left with the American people to prevent a comparative handful of

disgruntled foreigners, fed on the destructive doctrines of the I. W. W. and organized to obtain their selfish ends at any cost to the public, from subverting the Government of these United States and plunging the nation east of the Rocky Mountains into a glacial condition of industrial paralysis and famine.

IN a recent issue we referred to the flotation, in London, of a new financial and mining company called the Mexican Corporation, organized by the group controlling the Camp Bird and Santa Gertrudis companies. It is announced that this new venture has acquired a large interest in the Teziutlan Copper Company and in the Fresnillo Mining Company. Stock to provide capital for this business has been offered, and taken, by the shareholders in the Camp Bird and Santa Gertrudis companies. The Teziutlan Copper Mining & Smelting Co. owns mines near Teziutlan, in the State of Puebla and about 130 miles east of the city of Mexico. These have produced steadily since 1900, yielding a quartzose chalcopyritic ore free from zinc, arsenic, or antimony. The smelter started to work in 1910 and has exemplified the most up-to-date practice. In 1913 the Mexican revolution compelled the plant to be closed down. The late Robert S. Towne was identified with this enterprise. The Fresnillo Mining Co. is a New York company operating silver-gold mines in the State of Zacatecas. These changes of ownership are to be welcomed as indicating the revival of interest in Mexican mining and the willingness of capitalists to commit themselves to operations in that great mineral region, despite the lawlessness and disorder that unfortunately have retarded industry during recent years. Evidently a continued improvement of affairs in Mexico is anticipated in London.

GOLD MINING in Western Australia has received a filip by reason of discoveries made at Hampton Plains, the scene of some of the earliest prospecting in that State. The district is near Coolgardie and was controlled mainly by the Hampton Plains Estate company, which was organized in 1894, but was so unsuccessful as to be reconstructed in 1906 and again in 1909. At that time the name was changed to Hampton Uruguay Limited, by reason of a large subscription to the Uruguay Consolidated Gold Mines, which owned property in the Riveria province of Northern Uruguay, in South America. The latter company went into liquidation and was wound up in 1914. Meanwhile the mines at Hampton Plains had been worked precariously until 1912, and in September 1914 the parent company likewise went into the hands of a receiver. It was regarded as a dead venture when, in June of the current year, a party of prospectors found rich gold-bearing quartz on Block 50 of the freehold property of the Hampton Properties, a Scottish enterprise in which the Hampton Uruguay company holds a large interest. A prospecting shaft disclosed a lode 25 feet wide, similar in character to the ore-channels that have proved so productive at Kalgoorlie, which is 22 miles distant. Immediately attention was drawn to this abandoned goldfield and renewed exploration resulted in other finds of a most promising character. Miners congregated thither and leases were given to them by the proprietary companies, whose careers had seemed to be closed definitely. During September the Hampton Properties company issued 268 licenses, while the Hampton Uruguay company issued 201. A correspondent of the London 'Financial Times' reports that a shaft has been sunk on Hansen's lease to a depth of 100 feet, disclosing "an oxidized formation similar to that in the Kalgoorlie mines". The ore averages 27½ dwt. per ton all the way down for the full width of the shaft. On the Syndicate lease 30-dwt. ore has been exposed on the 100-ft. level in sulphide ore. Stock in the nearly defunct companies rose in a few weeks from a few pence to 51 shillings per share, an eager gamble having been incited by the surprising nature of the disclosures. A rush of diggers from all parts of Australia to Hampton Plains is reported from London and a number of syndicates have been organized there and in Australia to take part in the scramble. Fourteen miles of claims have been staked on the strength of these discoveries. One good effect has been to revive prospecting in other moribund gold-mining districts in Western Australia, notably in the Broad Arrow district.

Class Journalism—III

Literature is a criticism of life; class journalism is a criticism of the life of a particular class, meaning thereby not a stratum in society but a group of people engaged in the same occupation and having interests in common. At the present time there is a tendency on the part of engineers toward a larger participation in civic affairs; it is being emphasized that the engineer is a citizen as well as a technician and that his personal welfare, that of his profession, and that of his country call upon him to arouse his political sense, particularly his appreciation of the business of government and legislation. This tendency has been accelerated by the War, in which the engineer awakened to his opportunities for patriotic effort and quickened to a wider interest in big affairs outside his profession. During the War every thoughtful man learned to think on subjects usually beyond his mental horizon, largely because he felt the impact of events and the incidence of actions outside his normal life. The War was a brutal teacher, but it did open the eyes of the professional man, and of those engaged in the trades with which the professions are allied, to matters of worldwide importance, such as political geography, international commerce, and human relationships generally. In consequence, even the technical press felt itself called upon to discuss non-technical matters, recognizing that the tremendous problems of a great crisis in civilization were of more immediate consequence than the subjects to which it was ostensibly devoted. This broadening of the scope of technical journalism was, unconsciously perhaps, in accord with its underlying commercial purpose; during the last five critical years the journalism of the trade and the profession realized

its essential purpose and its true destiny, which is to minister to the thoughts of a class, and in that realization it awoke to a larger aim and a finer achievement. The engineering societies, which latterly have begun to utilize their publications for increasing their revenue by selling advertising space, thereby commercializing their scientific activities, have also bestirred themselves to the consideration of the humanities, especially the welfare of workmen and the relations of employer to employee, in which the engineer is deeply interested as a *tertium quid*. On every side there are signs of a widening of human thought and an education of the public to the complex questions underlying the progress of the art of living, which we call civilization. This is essentially the province of journalism, more so than that of the engineering societies, which, owing to the shifting personnel of their directorates and the indeterminate policies of committee management, are less fitted for the purpose, which is to guide and educate the opinions of the public, more particularly that part of the public engaged in technical pursuits and activities. A new era has opened for class journalism, if it will but avail itself fully of its opportunity. The readers to whom it makes an appeal are more than specialists in technique and industry, they are men and citizens responsive to the tides of human thought and sympathetic to the ideas that sway the political movements of the day. It is a mistake to suppose that the technical man nourishes his mind on technology alone; the technician feels the impulse of desires and interests far outside the work upon which his immediate subsistence depends. He likes, we believe, to read comment on the topics of the day in his own paper, because the editor or other writer in that paper belongs to his own class and views affairs at an angle similar to his own. He may read better editorials and articles on non-technical subjects in the metropolitan press, and rarely in the newspapers of his own provincial community, but the fact that what he reads in his own paper is written by a man of his own kind causes it to appeal to him with peculiar interest and sympathy. Moreover, it must be remembered by those living in the larger cities that many of the subscribers to class journals, especially the engineering periodicals, live in small communities, on the frontier, in the mountains, or in the desert, far from the nerve-centres of the world. These either have no local newspaper to talk to them, or such as they have is wholly inadequate as a source of general information on public affairs. To them their own class journal means much more than it does to the man in the big city; they look to it for comment and criticism on the larger concerns of life; through it they feel the pulse of the world and make themselves part of the wider existence beyond their physical horizon. With the development of democracy, or, rather, the growth of a democratic feeling between men, there will be less of the artificial stratification due to birth and wealth, and more of the solidarity that is founded upon similarities of work and aim. There may be also less of national and more of international feeling, but we are of those who believe that true internationalism must be based upon sincere nationalism, and that much of the internationalism of today is anti-social in its effects, if not its purpose, and that it still remains true that the best cosmopolite is the man who loves his own country best. This love of country, if accompanied by respect for other countries, and if joined to such solidarity of a trade or profession as breeds sympathy with those engaged in like trades and professions in other countries, will go far to improving human relationships and promoting the progress of civilization. The community of interests and feelings that is connoted by class journalism is not of a narrow kind; it does not shrivel the broader human sympathies; on the contrary, it disregards the narrow barriers of caste. The mining engineer is anything but parochial; he takes the whole earth for his field, and finds clients among all peoples and kinds of people. He is a man of catholic tastes and manifold aptitudes. Nothing human is alien to his understanding. If class journalism is to hold its own, if it is to fulfil its purpose of interesting him, it must grow with its clientele to a larger conception of its duty and a wider realization of its functions.

The Coal Strike

The die has been cast and the issue is plain: shall a small group of men, under cover of a strike for higher wages and shorter hours, overawe the whole country; shall the public welfare be sacrificed to the selfishness of one part of organized labor? Is the Government of the United States to govern or is it to submit tamely to the arrogant demands of any minority sufficiently organized to threaten the industrial life of the country? So far the strike has proceeded quietly and it is already evident that the belated action of the Administration has had a good effect, even if it fell short of the desired end, which was to prevent the strike. This it failed to do because the President's ultimatum and the legal steps taken by the Attorney-General came too late. They should have been taken a week earlier, not on the very eve of the day fixed for the walk-out of the coal miners. Two or three features of this controversy between organized labor and organized society call for consideration. In the first place, the President's reason for vetoing the prohibition measure, namely that the emergency created by the War was past, preceded his use of the Lever Act, a war measure, by only a few days. His action was claimed by the strike-leaders as a glaring inconsistency and unfair to them. The fact, of course, is that the veto on war-time prohibition was based upon the demobilization of the Expeditionary Force and not upon the end of the war in a legal sense. On the other hand, the use of the Lever Act is legally correct because peace has not been concluded. Moreover, the Government is entitled to use the Lever Act, or any other law, that enables it to prevent a great wrong being done to the country by the cessation of coal mining, and if no law existed on the statute-book for the purpose of defending the interests of the public, it would have been given the necessary authority, forthwith, by

Congress itself. Of that there can be no doubt. The Government in its drastic action, by proclamation and by injunction, does represent the will of the country; it is not acting in the interest of the owners of the coal mines or for any private interest; it is fulfilling its function as a government of the people for the people. The strike-leaders exclaim that the issuance of the injunction is "the most sweeping abrogation of the rights of the citizens guaranteed under the constitution", but it was to defend the rights of all citizens, in contradistinction to those of a group, that the injunction was requested by the Attorney-General; it was not issued in behalf of the mine-owners or for any group antagonistic to organized labor; it was the means thought to be the best available for preventing the perpetration of a crime on society at large. The granting of an injunction by the Federal court "does not involve the right", said the Attorney-General, "of labor to organize or strike, but it is based upon the Government's broad power to protect its people". The fact must be remembered that the wage agreement that the strikers sought to terminate at midnight of October 31 applied only to the central competitive coalfield, which includes Pennsylvania, Ohio, Illinois, and Indiana; it did not involve the other bituminous coalfields; therefore the attempt to enforce the demands of the miners in the central coalfield by declaring a sympathetic strike in *all* the coalfields, for the purpose of terrorizing the entire community, was an act of social sabotage; it was anti-social, undemocratic, and deserved to be fought by all the resources of the Government, moral, legal, and physical. Moreover, the Government has a direct interest in the strike, because it has 1237 contracts providing for the delivery of 387,000 tons of coal daily to the Railroad Administration. Since the maintenance of railroad traffic is vital to the industries of the country, the officers of the Government were justified, on this account as well, in taking every legal step within their power to prevent the general paralysis of industry and also the transport of troops. The outcry against the use of injunctions in such a crisis is insincere; the Attorney-General is known to be averse from the granting of injunctions to an employer whereby the processes of the courts can be used on an *ex-parte* hearing to force the employee into submission. "This is the Government itself using its own courts to protect itself from paralysis." It is the Government of the people acting for the people to prevent one small part of the population from holding the country by the throat in a criminal effort to enforce submission to its demands. At the time of this writing, on the first day of the week, it appears probable that an early and peaceful settlement of the strike will ensue. The use of the Army to maintain order, the embargo by injunction upon any overt action on the part of the strike-leaders, and the evident intention of the community at large to support the Government will suffice to dampen the ardor of the strikers and check the virulence of the radical element. The Government is endeavoring to bring the leaders of the two contending factions into conference, and Mr. Gompers appears to be assisting sincerely in furthering this purpose. The threatening attitude of the Railroad Brotherhoods seemed ominous at first, but they also appear to have responded to the pressure of public opinion. It is not unfair to the Government to say that the conditions under which the Adamson Act was passed, and the submission at that time to the arrogance of the four railroad bosses, prepared the way for the present lamentable condition of affairs. The threat made successfully by the Railroad Brotherhoods to stop all railroad traffic unless their demands were honored by Congress had a most pernicious effect, in that it indicated the practicability of 'holding up' the Government of the country by such means when the next occasion arose, as it has now. If the President and his cabinet had not shown a firm hand at this time, it seems certain that the organized labor of any basic industry could have enforced acceptance of its demands by the mere threat of a general strike. Here we come to the fundamental question: are general strikes consistent with the American idea of civilization? We emphasize 'American', because so many of these violent expressions of labor-unionism are distinctly alien in character; they are supported mainly by foreign workmen, intoxicated with revolutionist propaganda, of Irish, German, or Russian origin. The right to strike, against which sundry reactionary politicians are trying to legislate, is one that cannot be denied at this late day. A man has the 'right' to work or to cease work, but only so long as his cessation from work does not do great harm to his fellow citizens. We would not tolerate, for example, a strike of physicians, because it would be so obviously a menace to all of us; a man's 'rights' are circumscribed by his obligations and responsibilities as a member of society. The ordinary strike, used as a last resort in collective bargaining, is permissible because it is often the only means of protection against unfair or inconsiderate treatment by employers, but a general strike, more particularly a nation-wide strike, is an entirely different thing because it involves not merely self-defence on the part of a labor-union, or a group of unions, but a method of gaining particular ends by a general attack on the well-being of the people as a whole and a concerted attack on organized society. Again we assert, what every thoughtful man knows and recognizes in his daily life, that all the 'rights' we have under the law are conditioned upon our responsibility and obligations as citizens in an orderly polity. It is the recognition of these obligations that is the first principle of a democratic way of living. A man has not the 'right' to burn his own house, lest he cause annoyance or danger to his neighbors; a man has not the 'right' to beat his own wife or misuse his own children; he has not even the 'right' to end his own life. The Government of the United States today is asserting the fundamental concept of our American idea of civilization; every good citizen will support the Government wholeheartedly, and with supreme confidence that government for the people will not be swept aside by any truculent aggregation of labor-unions or of any other anti-social group in the community.

The Salaries of Engineers

The Editor:

Sir—I would like to add a few remarks to the discussion by R. H. Toll in your issue of October 18, on the salaries of engineers.

During a three months tour just completed in the mining camps of Nevada, Arizona, and New Mexico, I was impressed more than ever by the fact that "the wages of engineers is starvation". There is a strong feeling among the younger engineers of my acquaintance that they are not receiving fair treatment from the mine operators. These men realize that no matter how capable they prove themselves to be, they will reach a dead line in the course of a few years at a salary of from $175 to $250, an amount above which it is impossible to rise without the death or resignation of some higher up or without leaving the organization and taking chances with another company, usually smaller and less stable.

On the other hand, the mine operators complain that while the quality of the men being turned out by the leading mining-schools is very good, as soon as these men become useful to the company they are looking for better jobs elsewhere. The answer to this complaint is easy: pay the men on the technical staff according to their relative value to the company and make sure that the salaries paid are adequate to permit the men to live in reasonable comfort. No man is going to remain with one organization if he can get just as good a job offering an equal or better chance of advancement with another company. It is necessary to the engineer's progress that he study the methods used in many different places, and since his salary is insufficient to permit extensive travel, he is quick to seize an opportunity for working elsewhere.

The mine operators also protest against salary increases by saying that the work done is not worth any more money. This fallacy was beautifully disproved during the War when mining companies offered a base rate of $125 per month for mining engineers as surveyor's helpers, as compared to $85 or $100 per month previous to the War. Now that the War is over and base-metal prices have decreased (but not the cost of living) these same companies are paying a base rate of $90 to $100 per month for this work, excusing themselves on the plea that the men are not worth any more to the company, and that at any rate the supply is plentiful.

In many of the large mining companies in the United States, the salary of the chief engineer, chief geologist, or chief assayer is $250 per month plus a bonus based on fluctuations in the metal price. The highest salary for the men under them is $165 to $180 per month, and that can only be attained after many years of service. The practice in many of the mining companies employing white labor underground is to start the engineers as 'muckers' (a good thing in itself for those who have had no previous experience), then after a few months to 'promote' them to the engineering office at a salary less than they were receiving as 'muckers'.

It is evident that the whole problem is a question of supply and demand with the operators holding the purse-strings and taking an unfair advantage of the normal excess of supply over demand. While it is quite true that a large mining company needs many routine men and that these men need not possess high qualifications, it hardly seems fair that they should be penalized for the loyal and submissive service they render to the company simply because they are unorganized.

Comparing these conditions with those prevailing in the petroleum industry, we find that so-called oil geologists are started fresh from college at salaries ranging from $175 to $250 per month, and there is a disposition among leaders in the petroleum industry to regard this as a permanent condition. The salaries paid for the higher executive positions and for consulting work are no higher than in metal mining. The young oil geologist is entitled to the salary he is paid, as he is evidently worth it to the company. Why cannot those wishing to start in metal mining have an equal chance?

W. F. Dietrich.

Stanford University, October 22.

The Index-Number Wage

The Editor:

Sir—In the issue of 'Commerce and Finance' for May 7, 1919, the editor, Theodore H. Price, presents an interesting account of the 'Index-Number Wage', or a scientific method for adjusting wages to the cost of living. The following is a digest of his article.

In what is known as the 'index-number', we have the first scientific effort that has been made to determine just what the decreased purchasing power of money is. Any effort toward this end is worthy of careful study by those who look forward to the time when wages and prices shall be intelligently regulated in conformity with economic law and the costs and wastes of strikes and deceptive bargaining shall be avoided.

The index-number represents the average of the prices of the commodities that are essential to civilized existence. The prices must be averaged at successive dates (usually at regular intervals), and a comparison of the

index numbers for different dates will show the average decline or advance in the price of commodities during the period under consideration. Since the wants of civilized man include a great many different things that are consumed in different proportions, it is necessary that the index numbers, to reflect accurately changes in the cost of living, be not only the average of the prices of a large number of articles, but a weighted average as well. The price of each article is therefore multiplied by a factor which about equals the ratio that the consumption of the article (or group of articles) bears to the total normal consumption.

The index number compiled by the R. G. Dun Co., known as Dun's number, includes the prices of some 300 products, so arranged that foods count for about 50% of the total, textiles for 18%, minerals for 16%, and other commodities for about 16%. The division, of course, is arbitrary, but it is an approximation of fact, and the number of commodities included is larger than the number used in the composition of any other index now known. Index-numbers are published by other authorities, among which are Bradstreet's, Babson's, the U. S. Bureau of Labor Statistics, the 'Statist', and the 'Economist' in England, and the Department of Labor in Canada. Index-numbers are also compiled, either officially or unofficially, in Australia, Austria-Hungary, Belgium, Denmark, France, Germany, India, Japan, Netherlands, New Zealand, Norway, Russia, and Spain.

The index-number wage has been adopted by several American corporations. The details followed in each case differ somewhat, but, in general, the plans are similar. The base taken is the wage paid upon a certain date, when it is assumed that earnings and the cost of living were in equable relation to each other. On subsequent pay-days the employees receive two envelopes, one containing the base wage, and the other, often called the H. C. L. envelope, containing a percentage of the base wage equal to the percentage of advance in commodity prices over those current at the time the base wage was established, as shown by the most recently published index-number. Some of the concerns using this method of paying wages are: the Oneida Community of Oneida, New York; the Kelly-Howe & Thomson Co. (hardware), of Duluth; the George Worthington Co. (hardware), of Cleveland, Ohio; the Prints Biederman Co. (clothing) of Cleveland; the Index Visible (Inc.) of New Haven; the Mishawaka Woolen Mfg. Co., of Mishawaka, Indiana; and the Union Bleaching & Finishing Co., of Greenville, South Carolina. The South African Gold Trust Co., Ltd., of London, follows this method in paying its clerical force.

It is believed that the use of the index-number wage will provide a permanent solution for many problems that must confront both employer and employee as the purchasing power of money changes. Such a wage, rising and falling as the cost of living fluctuates, would, to a great extent, obviate strikes, lessen discontent, and reconcile the wage-earner to lower wages when prices decline, because he would realize that when they went up again his pay would increase without any demand on his part. The employee would be led to study economics and to practice an intelligence in buying that would make extortion or profiteering on the part of the retail merchant with whom he dealt extremely difficult. One concern encloses in the H. C. L. envelope a slip giving the wholesale prices of most things the employees need. By comparing them with the retail prices demanded, it is at once evident whether the storekeeper is asking more than a reasonable profit.

An interesting variant of the index-number wage is given in a letter from W. A. Stinchcomb, county engineer in Cuyahoga county, Ohio. In his office there are nearly one hundred engineers, draftsmen, field-men, clerks, etc., who are employed on road work. These were asked to fill out a questionnaire on which information was asked relative to the number of dependents, whether the employee rented or lived in his own house, and a distribution of his salary into the following items:

1. Food.
2. Clothing and shoes.
3. Fuel and light.
4. Rent.
5. Miscellaneous expenses.
6. Savings.

Since the salaries paid to employees ranged from $1000 to $3600 per year, it was apparent that it would not be fair to pay the bonus on the same index to all men, for the percentage of his salary paid by the employee with a small salary for food would be larger than the percentage paid by the man with a greater salary for the same item. The returns from the questionnaire were classified into three groups.

	Class A Salary less than $1600	Class B Salary $1600 to $2400	Class C Salary over $2400
	%	%	%
Food	38	37	27
Clothing and shoes	15	14	13
Fuel and light	5	6	3.3
Rent	21	21	16.5
Savings	8	10	20
Miscellaneous	13	12	20.2

The commodity values reported by Bradstreet's for food, clothing, and partly for miscellaneous were adopted as a basis for computing the index for those commodities. A sub-division was made in the matter of fuel and light, separating gas and electricity from coal, as the prices for gas and electricity remained fairly constant. The investigations made by the Cleveland Real Estate Board were taken as a basis for rent. The index values for February 1919 were as follows (the index values for January 1917 were taken as the base in all cases):

Food	1.426	Rent	1.150
Clothing and shoes	1.132	Miscellaneous	1.146
Gas and electricity	1.000	Savings	1.000
Coal	0.844		

These commodity indexes taken as a factor, times the percentage used by the men of the various classes, provided for February the following bonuses, which were paid in addition to the fixed salary base as determined in January 1917.

	%
Class A	23.00
Class B	22.27
Class C	18.57

The peak of commodity prices, and therefore in salary

bonuses, was reached in December 1918, when the following indexes were established:

Food	1.570	Rent	1.150
Clothing and shoes	1.746	Miscellaneous	1.184
Gas and electricity	1.000	Services	1.000
Coal	0.876		

On this basis the bonuses paid were:

	%
Class A	28.64
Class B	27.61
Class C	23.18

Apparently the system has given satisfaction; it has merely established an act of justice between employer and employee. It is an attempt to pay for services in the things that the employer and employee need and use, and which do not bear a fixed and constant relationship with the dollar.

ROBERT S. LEWIS.

Salt Lake City, October 16.

Gold, Prices, and War Debts

The Editor:

Sir—Mr. Brinsmade's contribution to 'Discussion', in your issue of August 16, is of great interest. While there is an inequality of wealth, and a stiff inheritance tax seems to be the one method by which dynastic control can be broken, unfortunately corporations and nations do not die; hence the machinery for exercising great power exists, and so although we may tax a family out of control, some other person or persons will succeed to that control. A discussion of this phase of the question would be apart from my present object, and although I hope at some future time to have an opportunity for enlarging upon the idea, I would, in passing, record the thought that a limited term of office, for officials in charge of great corporations, might have a restraining influence both upon the officials and the corporations under their control.

While agreeing with Mr. Brinsmade as to general causes and effects in regard to high costs, I am not prepared to subscribe to some of his statements. It is difficult to bring into agreement his fling at "humane but superficial economists who form the unwitting claque of professional labor-monopolists like Mr. Gompers" and his statement, "No! it was not a low wage scale that made 'pre-war standards' unjust for Mr. Robbins' laborers; it was rather the plundering they underwent by various classes of cunning monopolists, who, under legal forms, carried off to their private coffers the lion's share of the social wealth, etc." For every force there is an equal and opposite reaction, and if we have extremists in finance we must expect extremists in labor, and every social movement must have its leaders. I have great respect for Mr. Gompers, largely because of his successful avoidance of the creation of a labor party in politics.

An acknowledgment of class distinction is absolutely un-American, and the preservation of Congress as the forum of all the people, without regard to the continental divisions of labor, capital, aristocracy, and religion, is to safeguard republican principles. Labor-monopoly is an ideal, and ideals must by their nature be in advance of what can be accomplished. The recent demand of railroad employees concedes a place to brain-labor, and by so doing robs "labor monopoly" of the dreaded establishment of the power of ignorance. Nor can I concede that conditions have been made unjust entirely by "plundering classes of cunning monopolists". I have seen so many mining magnates, who "toiled not, neither did they spin", created by nothing but accident, that I know the blame for their affluence cannot be ascribed to cunning. It is true that much deceit is practised in business, but since the days of Jacob and Esau it has been necessary to recognize this human trait. Our failure to formulate laws that successfully limit the prizes won by luck and deceit is due to our lack of knowledge. We are learning by experience how to regulate our affairs, but, such is our blindness, as the human family advances in knowledge, that knowledge must first be applied to the taking of an unfair advantage before the unfair advantage can be recognized.

I do not at all agree that "It is only the uninformed who fancy that organized labor speaks with preponderant authority". My experience with organized labor dates back to the time of the Haymarket riots in Chicago, at which time I was working as a shop boy in a brass works. Our shop was ordered out on sympathetic strike, although we were unorganized and our wages and hours were better than those demanded by the unions. In Philadelphia some twenty-four years ago, as a traction company employee, I had a close-up experience with a street car strike. During nine years in South Africa I watched the gradual growth of labor organizations; for two years in New York, as an employer, I was continually dealing with a variety of labor organizations; and in eleven years in Canada, I was engaged in three struggles against unlawful domination by the Western Federation. I state these facts in direct opposition to Mr. Brinsmade's statement that it is only the "uninformed" who fancy that organized labor speaks with authority. If 10% of the people interested are organized upon any question pertaining to labor, capital, politics, or other activities, that 10% speaks with preponderating authority, for the vast majority of people do not think about the matters which affect them.

Mr. Brinsmade accuses me of not having much sympathy for holders of securities, which rather puts me in the category of those who live in glass houses. Be that as it may, Mr. Brinsmade stultifies his plea "Even when . . . wage scales . . . may have become adjusted . . ., there would yet remain the stigma of general defrauding of creditors to be palliated by those advocating the maintenance of this scale by artificial means, like debasing the coinage", when he refers to the "plundering classes of cunning monopolists" who have carried off the lion's share of social wealth. If the bulk of social wealth has been carried off as plunder by means of cunning (and luck), our conscience should be clear if we openly go after the plunder with a big stick. Honesty is based upon a recognition of the rights of others, and while we must avoid any readjustment that will disorganize our

social scheme, we must be careful that no misconception of what is honest shall deter us from doing what is best.

I confess that I cannot see any dishonesty in any adjustment of human affairs which benefits the whole family. For centuries, struggling humanity has been endeavoring to be honest with itself; to provide a more equitable distribution of benefits; to reduce poverty and suffering; and to limit the power of individuals and classes. We have driven ourselves into a fairly close observance of "Thou shalt not steal", but we have with blindness disregarded "Thou shalt not covet". Every so often, when the load of things put over becomes unbearable, the public (with honesty) shakes some of the load from its shoulders. Time was when war and revolution were readily resorted to in adjusting these matters, but we are trying to get away from such methods and are making our adjustments by sane legislation.

Mr. Brinsmade seemingly considers it dishonest to partly repudiate a payment due, by tendering a smaller quantity of gold than that agreed upon at the time the debt was contracted, and yet 95% of these promises to pay in gold have been made with a full knowledge that there is no possibility of fulfilling the promises in the event of all security holders demanding payment in gold. Payment in gold is understood to imply "payment in credits partly secured by gold", and except in comparatively few cases the security holders never demand gold. In California all real estate transfers are made "payable in gold", although both parties to the sales realize that payment will be made by check. In international adjustments, where gold is required to settle balances of trade, demands for gold may be large, but we know that there is not enough gold in the world to satisfy the payments due to this country by any one of the European powers, and we do not expect nor do we want payment to be made in gold.

Every time we increase the income tax or the inheritance tax, we are breaking the promises made and guarantees given to men when earning their incomes and accumulating their fortunes. We acknowledge that in spite of our best endeavors we have made mistakes; some have got more than their share of wealth, and we adjust the matter by taking away a part of the income or fortune. We cannot see into the future with sufficient clearness to enable us to frame laws that will not require adjusting. When we tax an income or an estate we are taking something away after it has been accumulated. Our action acknowledges that an error has been committed in allowing too big an income to be earned or fortune accumulated. But although our adjustment is a corrective for past mistakes, it is in no way a preventive against similar future mistakes. We adjust the result, but not the cause of the error. Without going into the pros and cons of adjusting the price of gold, I merely wish to point out that an adjustment that prevents an error is not so dishonest as an adjustment that corrects an error, for if it be against the best interests of the human family that men should become possessed of large incomes and fortunes, then a preventive is far better than a corrective. A preventive will act to discourage covetousness, cupidity, and even crime, whereas the corrective will tend to encourage these.

Gold is the armament of finance; it is the battle fleet that dominates the sea of commerce. The struggle among the nations to accumulate gold reserves has been no less fierce than the struggle to accumulate navies, and, strangely, the two embodiments of power seem to be corollaries of one another. The power of Great Britain to levy tribute upon the entire commerce of the world was built upon her ability to pay demands in gold. Her great system of foreign banking agents, which enabled her to buy exchanges at a discount, had a foundation of gold. When the merchant in South Africa purchased beef in Argentine, the transaction was facilitated by discounting the payment in London. Great Britain acted as a guarantor of the good faith and reliability of both parties, and levied a tribute for her good offices. But this constant accretion of wealth that streamed into the coffers of Great Britain did not benefit the mass of her people. Theoretically, the wealth thus acquired was used to promote and finance foreign enterprises, through financial control of these enterprises creating a market for products of British manufacture; practically, much of this wealth was invested in the United States, Canada, and upon the continent of Europe, where no markets for British goods existed. Thus the financial power of Great Britain steadily increased, but a great and unnatural chasm developed between the wealthy and the poor. The wealthy kept growing more wealthy because of foreign trade, while the poor kept growing poorer because of foreign competition, sometimes financed by British wealth.

The position of intermediary in foreign exchanges gave Britain a command and a direction over foreign trade, a command as contrary to the instincts of enlightened humanity as would be the placing of a fleet of privateer warships at the entrance to every harbor and demanding a tribute from the cargoes of all ships which pass in or out. We are talking of forming a League of Nations to police the world. One of the main features of the League is disarmament; there is to be freedom of the seas, whatever that may mean; but the underlying principal is that there shall be no domination of the weak by the strong. In the struggle between European nations, their gold reserves were spilled, and we picked up the big share of the scattered metal. Do we want the dominating power which goes with this reserve? Our merchants, our bankers, are not educated and trained in the piratical use of this golden fleet, and it is to be hoped, for our future peace, that they will not acquire the habit.

If the European struggle had been conducted in such manner that navies were not used, and we had exchanged field munitions for the various warships of the belligerents, and thus found ourselves in possession of the world's naval strength, would we be organizing this strength with a view to dominating the world and levying tribute upon all overseas commerce? That question was answered when we sent our navy to break up the stronghold of the Tripoli pirates. If by chance we had become possessed of the world's equipment of warships,

we would convert them if possible for commercial use, providing the rest of the world would agree to build no more ships of war. Having become possessed of the gold reserve of the world, our honest duty is to convert it into an exchange commodity for free circulation in peaceful pursuits, agreeing with the other nations upon a price which shall preclude hoarding and which shall carry no other power than the token value.

Mr. Brinsmade points out that the fall in the price of British consols constitutes my chief defence of the proposal to increase the price of gold. I chose this example because, so far as I know, it is the only case where the attempt has been made to definitely establish a permanent measure of the value of labor in terms of ounces of gold. It is true that interest rates have increased since 1812, and so have wages. There has been a constant seesawing between labor and capital, until in 1919 wages and interest rates have arrived at a condition such that the value of gold is indicated by the price of consols to be approximately thirty dollars per ounce. When the price of gold was fixed, it was fixed at the market price per ounce on the day upon which the legal price came into effect. That market price was the resultant between interest rates and wages of that date. The resultant today between interest and wages is about thirty dollars per ounce for gold. If wages are to be lowered, then interest rates must be lowered, otherwise dangerous conditions of strife will arise. But why reduce wages to the standards of 1915 or 1815? It is not the wages; it is the benefits that men demand. Those of us who have built up organizations in out of the way places know how often mechanics who can obtain work in the cities will relinquish the comparatively high mining-camp wage and return to the lower city wage in order to enjoy the schools, amusements, comfortable dwellings, and other benefits which the city offers.

There is profiteering at present among wage earners, middlemen, and capitalists. When the middleman finds his profits dwindling he will consider the advisability of joining the ranks of the producer, and there will be a gradual adjustment among the three classes in relation to one another. As the adjustment takes place, high wages, as expressed in dollars and cents, will make possible more hair-splitting economies. In the coinage of this country the smallest unit in which the ordinary man can think is one cent. At a wage of three dollars per day, this unit is ⅓ of 1% of his wage; at six dollars per day it is 1/6 of 1%. The stick of candy, the box of matches, and other articles which sell for one cent have not changed in price during the advance in wages; they have sold for the lowest available coin. While the expense of living is not due to the one cent purchases, yet when a man can divide his pay into six hundred units, he will be encouraged to practice a greater economy than would be practicable if his pay could only be divided into three hundred parts.

Present-day wages are inflated, as are the earnings of capital, but it does not seem possible that wages will return to pre-war standards, and there is every indication that earnings of capital will be curtailed.

The astute Oriental has always been a keen trader in precious metals. During the period of depression in silver Asia absorbed and stored tremendous quantities of that metal. Now India is exchanging her uncounted millions of silver bullion for gold, and that gold will be stored in the hiding places of the super-wealthy Indian potentates. The taking of gold from circulation is a condition to be avoided unless gold be demonetized. The storing of vast treasures of this basic commodity in a country unable to defend itself is a danger to the peace of the world, for it creates a temptation for any predatory political power that may be in a position to do so to possess itself of that great store of wealth and to use it in the advancement of self-interest. Moreover, the power of gold is already so great that any tendency to increase that power should be guarded against. The removal of gold from circulation within and between commercial countries, and its storage in the secret vaults of those who are not engaged in commerce, will intensify the power of such gold as remains in circulation.

We can still pay the debts which demand gold at $20.67 per ounce, and immediately commandeer the gold when paid; and although such a course would be a subterfuge, it would nevertheless allow us to live up to the letter of our agreements.

No student of present-day conditions can avoid the conclusion that tremendous social adjustments are in progress, and a self-satisfied reliance upon the inexorable laws of supply and demand to bring things to a satisfactory solution is a dangerous procedure. We have had titled aristocracy and financial aristocracy, and although there is an ever growing sentiment against these classes, they have served a great purpose in leading humanity. We have now built up an aristocracy of education, and it seems to be the task of this class to solve our social problems. If adjustments are to be made calmly according to the laws of supply and demand, then we must listen to those insistent demands that are being made for a more equitable distribution of life's benefits.

San Francisco, August 29. P. A. Robbins.

Tin is one of the few highly useful metals that are practically not produced in the United States proper. The output of tin from domestic ore in 1918 was only 68 tons, nearly all of it obtained from placers in Alaska. The tin imported in 1918, as metal and in concentrates, amounted to 82,854 short tons, the largest quantity yet brought into the country in any one year. Deposits of tin ore are found in California, Virginia, North Carolina, South Carolina, South Dakota, Washington, Nevada, and New Mexico, but the ore at some of them contains so little tin that it cannot be mined with profit. Tin concentrate from Bolivia was handled at four tin-smelting plants in this country, which produced from it over 10,000 tons of metallic tin. A report on tin in 1918, by Adolph Knopf, has just been published by the U. S. Geological Survey as a chapter of Mineral Resources for 1918, and can be obtained free of charge on application to the Director of the Survey at Washington.

The Cananea Ore-Bedding System

By G. W. PRICE

This plant was commenced and partly installed under the management of Arthur S. Dwight in 1905 and 1906 and completed and placed in operation by L. D. Ricketts in 1908. The details of this system were worked out by E. H. Messiter, consulting engineer for the Robbins Conveyor Belt Co. The object is to secure perfect mixture of the blast-furnace charge and at the same time provide a considerable storage for ore. This system, which was the first of its kind, has been in operation for ten years, except such time as revolutionary troubles have closed the smelter.

The ores from the various mines are hauled in trains of eight 30-ton Ingolsby dump-bottom cars over the company's 36-in. railway and weighed two at a time on a 120-ton Fairbanks scale, being dumped into one of nineteen 250-ton receiving-bins, from which they are drawn onto a 30-in. belt-conveyor, which carries the ore to a pair of 4-in. grizzlies over two 24 by 36-in. Farrel crushers. The fine from the grizzlies and the crusher product fall onto a 24-in. belt that delivers the ore to a Vezin sampler, which, at present, takes a tenth cut, the reject going to another 24-in. belt, which delivers it to a traveling tripper-car over the ends of the various beds.

The sample is fed onto a 20-in. belt, which delivers it to a 10 by 20-in. crusher followed by a Vezin sampler, which again cuts a tenth for the sample. The sample falls into a No. 2-D Gates gyratory crusher followed by a Snyder sampler cutting one-fifth. This passes through a set of 14 by 20-in. rolls and leaves the sample of 600 to 1000 lb. in good condition for mixing and quartering on plates in the usual manner. The reject from the sample in each case goes to a bucket-elevator, which delivers it to the 24-in. belt carrying the main stream of ore to the belts over the beds where it is discharged onto one of three 22-in. conveyors equipped with an automatic traveling tripper-car, which distributes the ore on a bed about 50 by 400 ft. These beds usually contain about 10,000 tons of mixed ores and furnace by-products when completed and are reclaimed by one of two Robbins reclaimers, having a capacity of about 200 tons per hour. These machines deliver the charge onto a 20-in. belt-conveyor, from which it is taken by a 22-in. belt up an incline above the furnaces, where it falls onto a 20-in. belt delivering it to the various furnace-bins by means of a traveling tripper-car. These bins contain about 70 tons of ore each and allow for shut-downs of the reclaiming plant for three to four hours, which is ample for necessary repairs, belt changes, etc. The entire system employs about 40 men during the 24 hours and is in charge of one American foreman, all the other employees being Mexicans, who make the necessary repairs. The maximum tonnage reclaimed and smelted by the blast-furnaces during 24 hours is 3800 tons, while over 4000 tons per day have been bedded.

This system has handled over six million tons of ore as follows:

COST PER TON OF SAMPLING, BEDDING, AND RECLAIMING

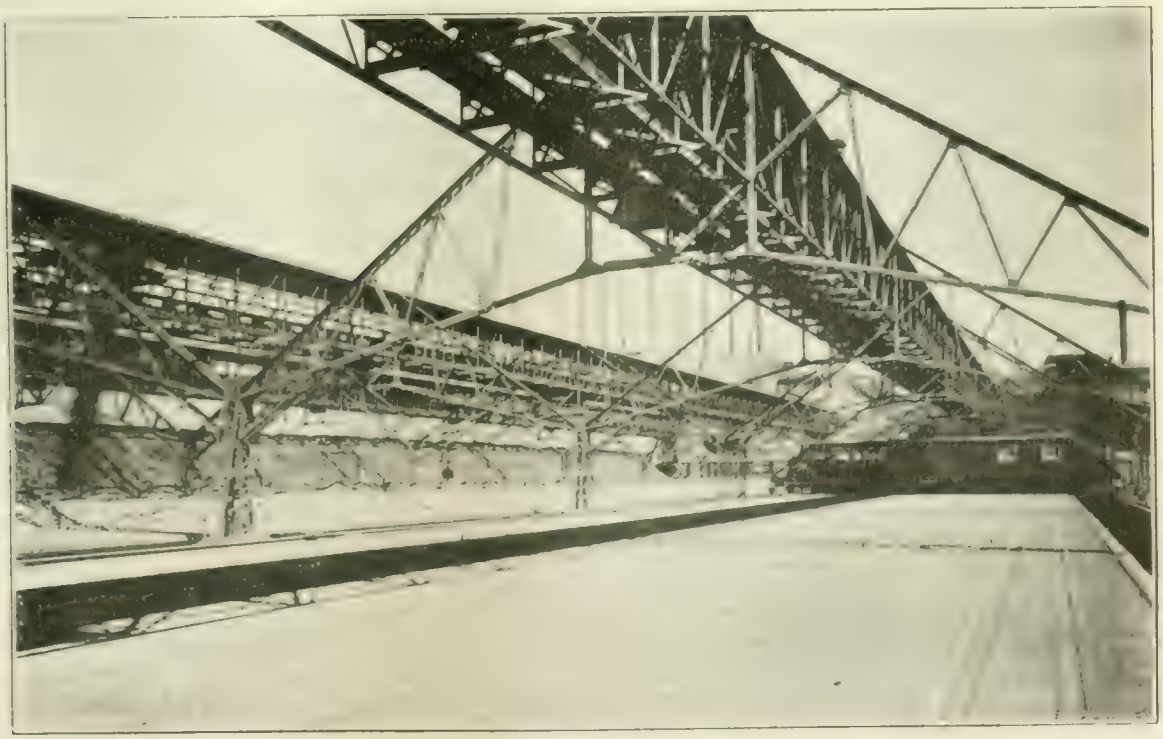
Year	Tons	Operating	Repairs	Total
1908	211,340	0.1783	0.0370	0.2153
1909	564,237	0.1267	0.0362	0.1629
1910	578,235	0.0936	0.0149	0.1085
1911	611,330	0.0771	0.0140	0.0911
1912	700,621	0.0813	0.0118	0.0931
1913	560,340	0.0812	0.0091	0.0903
1914	326,543	0.0577	0.0204	0.0781
1915	212,537	0.0681	0.0704	0.1385
1916	930,543	0.0746	0.0437	0.1183
1917	509,416	0.0969	0.0504	0.1473
1918	903,633	0.1092	0.0448	0.1540
	6,108,775	0.0923	0.0307	0.1230

These costs include all renewals, changes, improvements, and repairs during the ten years. The system is in first-class operating condition and should last indefinitely, except for such repairs as are made from day to day. The belt-conveyors last from six to nine months where the service is especially hard, and from five to six years where the service is lighter; several belts having handled 1½ to 2 million tons of charge before needing renewal.

This system has resulted in a great saving in labor and coke, and it seems to be a cheap and dependable method of getting a perfect mixture for the blast-furnace charge, and at the same time providing storage of 10,000 to 20,000 tons capacity.

THE three minerals most needed to make our agricultural industry more productive and more prosperous are potash, nitrate, and phosphate. Most of the potash and nitrate we use is imported, but our domestic supplies of phosphate are abundantly ample to meet all our requirements, and for years we have been heavy exporters to Europe. The total quantity of phosphate rock in the United States in 1918 was nearly 2,500,000 long tons, having a value of more than $8,000,000, over twice as much as was produced in that year in all the rest of the world. Florida alone produced more than 2,000,000 tons, having a value of about $6,000,000. A report on the phosphate-rock industry by R. W. Stone, which has just been published by the U. S. Geological Survey, gives the details of production in 1918 by States and by kinds of rocks, shows the world's production by countries and by years from 1910 to 1918, and includes tables showing exports by countries. The report also describes the distribution, character, and method of mining phosphate-rock.

THE BEDDING SYSTEM AT CANANEA



DISTRIBUTING THE ORE BY A TRAVELING TRIPPER-CAR

The Premier Gold Mine, Portland Canal, B. C.

By CHARLES BUNTING

*Much has been written about the Premier mine, situated near the head of the Portland Canal, which, while interesting, is at variance with the facts. The writer is well acquainted with the property, its orebodies, values, and history, and will briefly review the facts relating to the above and indicate the immense possibilities of this remarkable mine. All the known orebodies of the Premier, three distinct veins generally referred to as the low-grade veins, as well as the high-grade vein, are found on two of the company's claims. These are the Cascade Falls No. 4 and the Cascade Falls No. 8, which were two of a group of eight claims numbered 1 to 8 and known as the Cascade Falls group. They are situated on the western slope of the range which divides the Salmon river from the Bear river and were the first locations in that section of the Salmon valley. They were discovered and staked by William Dilworth and the Bunting brothers in June 1910. The two claims numbered 4 and 8, along with an adjoining group staked later by other parties, passed to the control of O. B. Bush, the Salmon-Bear River Mining Co. being organized by him during the winter of 1910-'11 to operate them.

The work done during the two following summers by the Salmon-Bear River Mining Co. consisted of short tunnels and surface cuts; it was confined to the low-grade showings, the results being fairly good. A great outcrop of good-looking quartz, containing some iron pyrite, and a little native silver was 'passed up' after a few shots had been put into it, and no attempt was made to trace it out. This outcrop has since proved to be the biggest and best surface showing of the high-grade vein.

The property was then idle until the summer of 1914, when it was examined for a well known eastern Canadian company by W. J. Rolfe. The outcrop attracted his attention and work commenced at once. The vein was traced for fully 800 ft. down the hill in a westerly direction, the surface was stripped and cuts put in at intervals along its whole length. The results were excellent, good ore being exposed in every cut, some of it running as high as $500 in gold and silver.

After securing such fine returns, for some unknown reason—possibly on account of the outbreak of the War—this company discontinued work. Credit is due W. J. Rolfe for his shrewdness in confining his work to this particular vein, to the exclusion of the low-grade showings, thereby demonstrating the presence of at least one large orebody running exceptionally high in gold and silver, with a lead content of less than one-tenth of 1%. Until this time speculation regarding the future of the camp had been based on the great showing of low-grade ore.

An entirely new conception of the potentialities of the camp was a direct outcome of his activity. The property was then immediately bonded for New York interests by H. R. Plate, and work commenced the ensuing winter. A tunnel, No. 1, was started at an elevation of 2100 ft. on the high-grade vein in good ore, and another tunnel, No. 2, at an elevation of 1850 ft. on the middle low-grade vein, also in good ore. No. 2 cut the ore-shoot diagonally for over 30 ft., the values being good. The tunnel was extended about 200 ft. beyond the ore-shoot into the country-rock, and a cross-cut of 30 ft. to the left from the face was also in country-rock. Work was then stopped in this tunnel. No. 1 tunnel was also driven diagonally across the ore-shoot, which left the tunnel on the right side at a point about 80 ft. from the portal. The tunnel was continued almost straight ahead—following a slip for a considerable distance—for a further 170 ft., a total of 250 ft., without picking up the ore again. A cross-cut was also driven to the right for about 12 ft., about half of it being in vein-filling, but lean. This tunnel was then abandoned. A cross-cut was then driven northerly from a gulch some 200 ft. south of tunnel. After being driven 60 ft. without getting ore, this too, was abandoned.

A cross-cut tunnel, No. 4, was now started farther down the hill, about 450 ft. below No. 2 and driven about 500 ft. before the vein was encountered. This proved to have a width of well over 100 ft., but was poorly mineralized. A drift of 40 ft. alongside a small diorite dike was run, in which some ore was just showing up when the New York syndicate threw up their bond and quit the camp, after operations extending over nearly 18 months at a cost exceeding $60,000.

In the summer of 1918, a few months after H. R. Plate had left, R. K. Neill of Spokane was induced by Pat Daly—who had been foreman for both Bush and Plate and still believed it would make a mine—to look over the property. The examination and sampling proving satisfactory, Mr. Neill bonded it the following winter for $100,000, beginning work in the spring. His first work was done in No. 1 tunnel at the point where the high-grade left it to find out what happened to the ore, with the intention of following it if it continued. A few shifts sufficed to show the vein was really paralleling the tunnel, and at no point in the whole 250 ft. of Plate's work was it more than 6 ft. away, while the face of the tunnel where work was stopped was actually in the vein.

As the vein here is almost barren—values $1.50—and closely resembles the wall-rock in which he had drifted for the last 160 ft., no doubt Mr. Plate failed to realize

*From the 'Canadian Mining Journal' of October 7. Mr Bunting is one of the original locators in the Salmon River district, now made famous by the Bush, or Premier, mine.

that he was in the vein. Had he, before deserting this tunnel, driven two feet to the right he would have been in $5 ore, while five feet ahead would have reached high-grade ore.

This is an outstanding example of a great mine being missed by a very small margin. It is just such hazards and great rewards that gives mining the fascination no other industry possesses.

When the first work showed beyond a doubt the real direction of the orebody, nothing more was done there. A cross-cut was started about 60 ft. farther in, and reached the ore in 6 ft. Plate's 12-ft. cross-cut was extended about 30 ft. After driving each of these cross-cuts into good ore for nearly 40 ft., without reaching the other wall, Neill decided to start a cross-cut from the face where Plate had quit, and also to drive ahead a further 600 ft. to get under the last of the series of open-cuts, which exposes the ore-shoot on the surface and shows it to have a width of from 100 to 150 ft. This cross-cut, No. 3, showed good milling-ore the first round; at 15 ft., high-grade came in and stayed the full length of cut. It was driven 82 ft. without reaching the hanging wall; a cut on the surface directly above shows fully 40 ft. of good ore yet to be cut. For some distance the full width gave values of several hundred dollars per ton in gold and silver, while the average for the entire 82 ft. is better than $55.

The face of the main tunnel was swung a little to the right and driven ahead. In four feet, ore running over $125 per ton showed up on the right-hand side; at 10 ft. there was a full face of ore, showing considerable native and ruby silver which gave values of $153 per ton. This tunnel has since been driven about 350 ft. farther and with the exception of about 30 ft., when passing through some almost barren ground, the full width of tunnel has been in high-grade ore, averaging several hundred dollars per ton.

No. 4 cross-cut, which is in about 40 ft., cut 10 ft. of high-grade, then passed into ore of a lower grade. No. 5 cross-cut, recently started, averages $50 per ton for the six feet it is in. This tunnel is now in a distance of approximately 600 ft., giving a vertical depth of nearly 300 ft. It has still to be driven about 200 ft. to get under the great surface exposure already described. This will give an additional depth of perhaps 50 ft. only, as the hill flattens considerably above.

In the block of ground 800 ft. long and fully 100 ft. wide as proved by surface-cut and underground work and from the surface to the present level, a tonnage of at least 1,000,000 can be safely estimated with a gold and silver content of $30 per ton, making a total of $30,000,000. A thorough sampling of all the present workings and openings gives an average value of well over $30 per ton.

As the ore-shoot is bigger, stronger, and far richer in the tunnel than on the surface, it is safe to assume it will continue for at least 50 ft. below the present workings. In that event—and any engineer familiar with this orebody would concede that much—a further $10,000,000 can be added to the above total. Work was resumed in No. 2 tunnel this summer, a cross-cut being driven to the right, to cut the ore-shoot about 150 ft. east of the portal where originally cut by Plate. In about 60 ft. the ore was broken into. It has a width of 10 ft. The average across is a little less than $20 per ton. This cross-cut was continued and has since tapped the ore-shoot to the south. The face is at present in good ore.

Each of these veins, and also another to the north of them, has the appearance of a potential mine. During the whole summer of 1918 the mine was shut down, work being concentrated on the construction of a sleigh-road from the beach to the mine, a distance of 16 miles, and a short dock at Hyder for the purpose of shipping ore the next winter. Owing to unforseen delays in the delivery of equipment and an exceptionally early break-up of the snow-road in the spring, only 512 tons was shipped, which gave smelter returns of $168,000.

PART OF BRITISH COLUMBIA. 'BUSH', ABOVE STEWART, MARKS THE POSITION OF THE PREMIER MINE

Two stopes have been opened up, putting the mine in good shape for shipping as soon as the snow flies. Since the snow went, operations have been almost entirely confined to outside work. A portable saw-mill is cutting lumber and a number of new buildings are being erected at the old camp for the accommodation of a greatly increased force of miners. The road is being widened and improved, and new barns and other buildings will be put up at the beach and nine mile. The saw-mill has been moved to No. 4 tunnel—H. R. Plate's last work—and a new camp is being built there. A compressor is to be installed and the present 5 by 7 tunnel enlarged to 7 by 7.

A cross-cut will be started a short distance from the face which will reach the high-grade ore-shoot in a few hundred feet, at an additional depth of 700 ft. below the present workings. Providing the ore-shoot holds its size and values at that depth—and the chances are decidedly in its favor—the figures relating to the tonnage and values will be almost startling. In that event, this property, which already ranks as one of the world's great mines, would then take rank as one of the greatest. It will still be possible to obtain a further depth of fully 500 ft. on the vein by driving another tunnel near the foot of the mountain, making a total of not less than 1500 ft. below the highest outcrop. With the downward extension of the orebody to this point it would be conceded the unique distinction of being the world's premier mine.

It remained for R. K. Neill to realize the possibilities dimly disclosed by W. J. Rolfe after others had failed, and his great success is in a large measure due to his good mining judgment, and his policy of staying with the ore whenever possible. Such phenomenal results after little more than two years' operations have been rarely, if ever, achieved before, even in mining, certainly in no other business.

The vein in which this orebody occurs is a true fissure. Its strike is N. 80° E., its dip steep and southerly. The vein-filling is largely quartz-porphyry, often changed completely to quartz. The metallic minerals which can be seen are argentite, stephanite, native and ruby silver, and iron pyrite carrying high gold-values, and there is reason to believe some of the tellurides are present in places.

Some wonderful specimens of native and brittle silver and ruby are obtained from a small persistent stringer in the big ore-shoot, which varies from 1 to 10 inches in width. The values of the whole orebody are fairly well divided between gold and silver, although the latter predominates. The dump at No. 1 has a value well over $200,000, practically every ton having been taken out in straight development. The mine is situated on a rather steep hillside ensuring the most economical mining. There is an abundance of timber for all purposes; also ample water for power, milling, etc., is right at hand. Associated with R. K. Neill of Spokane in this unusually successful venture were R. W. Wood and A. B. Trites of Fernie, B. C., and they are now, with W. R. Wilson of Fernie, the fortunate owners of this ideal mine.

The successful development of the Premier naturally caused renewed activity and interest, which resulted in the discovery of several new orebodies of the same character in different parts of the mineral belt. These showings have all the ear-marks of mines to a superlative degree so far as the surface is concerned. In some cases the surface exposures are bigger than those of the Premier with the values fully as good.

Placer Mining in Sonora

A few placer mines are now being worked by Mexicans in the Altar district, west of the stations of Magdalena and Santa Ana. There is scarcely any water in the district, and the miner is necessarily dependent upon dry-washing processes. If the many physical difficulties could be overcome, it is believed that satisfactory returns on a larger scale could be obtained, although transportation facilities are deficient and costly. The most economical methods of transportation probably would be by mule or burro. It would be necessary to carry drinking water and supplies for long distances, and a gasoline engine and a dry-washer would be needed. Owing to the increased wage scale, dry-washing is much more expensive than formerly; it is estimated that $1000 to $1500 would be necessary to begin operations even on a small scale. This region is relatively safe from Yaquis. East of Hermosillo and Guaymas the mining districts are at present infested with roving bands of Yaquis. It is the judgment of experienced mining men that nowhere in Sonora could placer mining be carried on satisfactorily or profitably by foreigners at the present time. The Altar district is the only part of Sonora where such mining is proceeding and all the work there is being done by Mexicans.

According to one authority the best place for placer mining is near Suaqui, north-east of Hermosillo. The gravel there averages about 18 cents per yard, and can only be worked with dredges. There is plenty of water in this district. The Llano-Colorado district also holds forth some possibilities in placer mining, although, owing to the flatness of the surface, it is difficult to establish sluices. Some years ago an American company built a water reservoir there at a cost of about $500,000, but, owing to the lack of drainage, the sluices could not be worked successfully. This district is reported to be rich in gold.

A placer mine is denounced in the same manner as any other mine. The denouncement must be made before the Agente de Mineria at Hermosillo. The expenses are about ₱50, exclusive of the engineer's or surveyor's fees. A deposit of ₱5 must be made for each 'pertenencia' of 2½ acres before the denouncement can be completed.

The Hot Springs district, in Alaska, has produced more than $6,000,000 in placer gold, as well as some silver and tin. Theodore Chapin, in Bulletin 692-F of the U. S. G. S., describes the occurrence of tin in the district, and gives an account of mining there in 1917.

The Detection of Salting

By MORTON WEBBER

The opportunity for salting largely depends on the location and size of the mine under examination. From experience in valuing mines in various parts of the world, I do not believe in a 'preventive' for salting. Like other forms of dishonesty the experience and intelligence of those attempting fraud is important in salting a mine successfully. A competent engineer should be able to prevent the work of novices if salting is attempted during his examination; but if the mine is large, it is almost impossible to prevent salting that is carefully devised. Prevention is further handicapped by the frequent condition of an examining engineer being forced to employ local talent for the manual part of the examination. He may have to pit his wits against the calculated plans of a trained engineer—a sort of fallen angel. As there are many methods of salting, any of which may be chosen or perhaps some ingenious combination of them, the odds are with the salters. They have the opportunity of secretly choosing their plan of attack. The young and meticulous engineer who is sent to examine a prospect may doubt this. When inspecting a prospect few samples are cut. They are cut by the engineer himself or directly under his supervision. Probably he seals the samples himself and they do not leave his sight until they are assayed.

During the examination of a large mine this personal attention is impracticable. It is not possible, because time is vital in the majority of mine examinations; especially under an option to purchase. The period allowed for examination in the case of a large mine under option is seldom in proportion to the work to be done. On small properties thirty or sixty days are commonly allowed for an examination; but on large mines involving the inspection of extensive workings, the mine sampling and investigation of title have to be completed in sixty to ninety days. It is in the latter case that the reporting engineer courts fraud. The only feasible means of sampling is to divide the work among sampling crews. As stated, such crews generally have to be augmented, to an important extent, by local talent.

The examination of the prospect seldom contemplates an important initial payment. Prospects are usually sold on a development basis. The incentive for salting, therefore, is usually absent. Large mines are invariably sold on a basis involving an important initial payment maturing immediately after examination. A dangerous relation is therefore evident: the opportunity of salting varies directly as the importance of the examination.

Recently I examined a mine containing about 15 miles of underground workings. This case is cited as representative of a large examination governed by present-day conditions. The terms of the deal can not be quoted in detail; it may, however, be stated that $300,000 had to be paid immediately after examination. If the vendee did not proceed further in the transaction, and make a payment involving a total of $1,000,000, the initial $300,000 was to be forfeited, together with subsequent payments, as liquidated damages.

During the tenancy of the option I had, in addition to the examination of the mine, to arrange for some important metallurgical investigations. This entailed making up a large composite sample of the ore. The sample had to be representative not only as to metal content, but also in its gangue constituents. A glass model was made of the extensive workings. This required 16 large panes of glass. In addition, 26 important mine maps had to be compiled. These details are given for the purpose of showing that it was impossible for me, as the examining engineer, to devote the time necessary to superintend personally the cutting of samples.

About 15 tons of face-samples were cut. This demanded several crews in order to complete the sampling in the required time. Pneumatic channelers were used on the basis of one channeler to a crew. I took with me an assistant, who was a trained engineer, and some trustworthy intelligent miners who had previously worked for me. Local men were assembled in crews; each crew working under one of my men. After the sampling-widths had been personally painted and tagged by me, the samples were cut and sacked by the crews. While each sample was, therefore, cut and sealed under the supervision of one of my men, the method lowered the quality of the personal attention necessary to prevent salting. One of the members of each crew might have had 'salt' in his tobacco, which would have gravitated with the ash from his pipe into the sample. Some may have had a weakness for long finger-nails, which picked up 'salt' when the hand was put in a pocket. Salt in chewing-tobacco may also have been available. As there are several other expedients of ingenious knavery, it would be courting a first-class fraud to depend on my own man in charge of each crew to prevent salting. To know that your own men are honest is not enough; there is too much at stake. To employ a Sherlock Holmes and a crew boss combined at $10 per day is not feasible.

To ensure safety I believe that protection must be sought by arranging for the 'detection' of salting and not its 'prevention'. It is, however, advisable to continue to seal samples immediately they have been cut. The practice is orderly and impresses the sampling crews with the importance of the work; but an engineer making

an examination involving a large sum of money should drop the idea that sealing samples ensures protection. If 'salt' is going to be introduced after or during cutting, but prior to the opening of the sacks for the crushing and reduction of the samples, it will be done by some of the methods heretofore mentioned. If it is desired to salt the sample after sealing, this can be done by a syringe and not by clumsy meddling with the seal. If, moreover, the crew boss is given a seal and uses it immediately on sacking, the psychology is productive. It conveys the impression that you are relying on his honesty and thoroughness, and thereby his best may be brought out.

The following plan, I believe, will disclose salting, before submitting the report, no matter how ingenious the scheme, for all methods of salting depend on introducing the fraud at one or more of the following stages:

(1) Preparation of the mine faces before the arrival of the examining engineer.

(2) Introducing salt into the sample during the cutting of the sample.

(3) Injecting salt in the form of solution into the sample-sacks.

(4) Secretly dropping salt in the sample during crushing, mixing, or reduction to pulps.

(5) Rubbing salt on the bucking-board and crusher-jaws after the examining force has gone to bed. This method is only applicable in gold and silver examinations, the limitation being due to the small proportion of salt that can be retained on the surfaces.

(6) Introducing salt into the flux. This refers to examinations where assaying is done at the mine.

(7) Fraudulent assays submitted by the assayer. This refers to examinations where pulps are sent to a custom assayer.

Many engineers employ some of the methods of protection hereinafter set forth. The prime value of protection herewith suggested depends on a combination of former practice with a 'key series' to be described. Nearly all the old methods of detection fail to afford sufficient security. For example: many engineers employ a 'dummy'. Crushed samples of rock containing no ore are secretly conveyed to the workings by the examining force. The intention is to allow the dummy to pass into circulation with the other samples. If the samples are being salted the dummy will get salted and expose the scheme. Like the sealing of the sample-sacks, the introduction of a dummy does not ensure absolute protection. In the preparation of faces prior to the arrival of the examining engineer (No. 1) the successful drifting through of the dummy without being salted would give the examining engineer a fictitious feeling of security totally unwarranted. It would also fail to expose salting during the cutting of the samples as described.

The dummy, however, is used by me as part of my combination means of protection because it will detect salting if attempted by methods No. 3, 4, 5, and 6. It would be of no value in exposing methods No. 1 and 2, and it is doubtful if it would expose No. 7, because a dishonest assayer would probably not tamper with an assay that showed a 'blank'. The dummy, however, is an infallible means of detecting salting done by method No. 5.

My key series is as follows: Before commencing sampling I first endeavor to acquire a thorough grasp of the mine under examination. This is necessary to sample the mine intelligently. Then I proceed personally to whitewash the strips to be sampled. This part of the examination is always done by myself. The subsequent cutting of the samples and their reduction to duplicate pulps is mechanical, requiring only well-trained subordinates.*

After the sampling is completed, I re-sample a series. From 10 to perhaps 30 channels are re-cut, depending on the scale of the examination. The re-channeling of several cuts is not an uncommon practice with engineers; but I depend on the improvement of a key series. For example, after the sampling is completed or nearly so, but prior to the platting of the samples, I go through the workings and remove the tags of a number of cuts, substituting new numbers. I then give a note of the new numbers to an assistant and have them re-cut. The key giving the duplicate numbers, each to each, is not allowed to leave my possession. It is in keeping this information strictly to myself that I depend on detecting salting. In my judgment this is an effective method, because its simplicity does not require me to take even my chief assistant into my confidence. The penalty for being salted on an examination involving a large sum of money is so great that the engineer is entitled to take this precaution. Not only will this key series detect salting, but it will also disclose the efficiency of the sampling. It will expose faulty channeling, incompetent mixing and cutting down, or inaccurate assaying.

It is necessary to point out that the common practice of tagging sample-cuts in consecutive order should be discontinued. A drift, for example, should not be tagged 358, 359, 360, 361, and so on. If, when using the key series, the examining engineer desires to re-sample 359 as being one of the re-cuts for the series, and removes tag 359, substituting number 635, but leaves undisturbed 358 and 360 on either side of the original tag removed, the presumption is that 635 was originally 359. The protection of the key is lost. Also there is no evident gain in tagging samples consecutively. All that is necessary is for each cut to be tagged by a number so that its position can be platted by the surveyor. In my practice the surveyor follows the sampling crews. His duty is to plat the samples and check the width sampled.

It may be argued that a careful salter would take care to inject a uniform quantity of salt, so that the re-cut sample would contain the same proportion of salt as the original. It was the recognition of this danger that made me devise the key series. Safety lies in the fact that it is almost impossible to go over a channel a second

*While the cutting and treatment of the samples are mechanical, the decision as to their position and width should fall squarely on the shoulders of the examining engineer. It is in this phase of the work that he is called upon to show his ability as a valuer of mines.

time and cut the same weight of sample. If a sampling crew removes, say, a 50-lb. sample from a 5-ft. cut, on going over the same channel a second time a great difference will be found in the weight of the second sample. It will be either considerably more or considerably less; yet the second sample can be equally representative. To salt successfully a key series it would, therefore, be necessary to know the weight of the original sample and put a proportional quantity of salt into the original and the duplicate, depending on weight. By tagging the sample-cuts indiscriminately and retaining the vital key on the person of the examining engineer, it is impossible for the salter to obtain this information.

The object of using a series instead of comparing each re-cut separately with the original is that it frequently happens that a re-cut will not sufficiently correspond in assay with the original sample. This is common in mines where the metal value is in the form of friable sulphides. In such cases the re-cuts will seldom correspond, each to each, but in comparing the average of a series of ten to fifteen re-cuts the law of average is brought to bear. I have frequently instituted a series where there were discrepancies of several dollars between every original and re-cut, but the average of the series checked to a few cents.

Some other features in the application of the key series may be considered. The key series is never employed in unimportant workings where there would be little object in salting. Also the series is never confined to one portion of a mine. In a large examination I use three or more series. Preference is always given to vital parts, as for example, the lowest level, important crosscuts through supposed ore, and points approaching the face of development drifts. Generally speaking, the place to suspect salting is in workings vital to the consideration of the future life of the mine. One of the most desirable mines to salt is a gold or silver mine with some actual ore developed, which can stand sampling without assistance, and where one or more winzes and the horizontal extremities of the lowest level are supposed to be in high-grade ore. Assuming that the mine had not been salted, a large initial payment would be justifiable.

An attempt was made to foist such a property on one of my clients. The key series, however, disclosed the fraud. While the standing ore in the mine assayed as claimed, a winze from the lowest level and also the horizontal extremities of the lowest level had run out of ore. This combined evidence indicated the superficial nature of the deposit. The owner had endeavored to convert these openings into exposures of high-grade ore. He inferred correctly, that if his scheme succeeded, he would swing the valuing evidence just as far in favor of the mine as the truth was against it. It transpired subsequently that the owner had injected filings from the gold and silver coinage of the U. S. A. into the cracks and crevices of these vital extremities by means of a shot-gun.

The use of the shot-gun is difficult to detect, except by the key series, for sampling additional faces would only mean additional salting. All the usual methods employed to protect against methods No. 2 and 7 inclusive would be nugatory, because the sample is salted at the fountainhead. This method will shoot salt into the cracks and crevices. In the actual case cited, both the re-cut and the original were salted. The key series, however, exposed the fraud by indicating a wide discrepancy between the average of originals and re-cuts.

The reason for stating that the class of precious-metal mine, above mentioned, is particularly adapted to salting is as follows: The use of the shot-gun is probably the method of salting most difficult to detect. To salt a mine by this method is, however, most expensive, and herein is the value of having an ore-reserve that will stand sampling unaided. The salters can confine the expense to salting the winzes and other extremities vital in the consideration of the future life of the mine. Some years ago I sampled a gold mine in California. The mine had a fair amount of profitable ore in sight. The ore-shoot, which was in a vein dipping about 45°, had a definite rake to the south. The lowest level, as represented by the vendor's assay-maps, seemed decidedly the best level of the mine. It also indicated the coming in of an additional shoot evidently on a horizon lower than the original shoot. A winze had been sunk in the new shoot, which showed ore of higher grade than the supposed average of the mine. All these facts substantiated the statements of the vendor that the future of the mine was of excellent promise. This, in addition to the standing ore, which actually existed, seemed to justify the large initial payment required in the terms of the option. A few dummies sent down every third day always assayed blank. It was equally evident that the local assaying was reliable. The key series showed that the ore above the lowest level actually existed. It, however, showed that the lowest level 'bottomed' the mine, that the new shoot was a myth, and that the only merit the enterprise possessed was as a gutting proposition.

In respect to protection against method No. 6, my practice may be of interest: In precious-metal examinations, when assaying is done at the property, flux and slag assays are made daily. At frequent intervals I transfer several pulps of samples that have been assayed to new envelopes and instruct the assayer to have them run. The key giving the old and new numbers is retained by myself. This checking of the assayer is virtually a modification of the key series. In the last examination made by me, where assaying was done at the mine, my practice was as follows: An assayer and two helpers turned out about 50 assays per day. The crushing, mixing, and reduction to duplicate pulps was done in another building. This department was under an assistant. The duplicate pulps, as obtained, were packed in boxes by this department. Only the original pulps went to the assay-office, in another building. The original pulps after assay were filed at the assay-office. On alternate days I went to the assay-office, changed ten previously assayed pulps to new envelopes for reassay, using a key series. In this way the work of the

assayer was always under scrutiny. Apart from his honesty, it proved that his work was reliable.

For protection against method No. 7, much the same system is used as against method No. 6. Instead, however, of having the custom assayer re-assay a number of originals, a series of duplicates, masquerading under different numbers, is forwarded for assay.

The checking of the assaying, if done at the mine or by a custom assayer, is not necessary to detect salting if the key series is used underground. The reason I institute this additional checking is to know, apart from fraud, that all departments are performing reliable work. This must be known while the work is proceeding. The dummy, however, is always used, as it quickly detects salting by methods No. 3, 4, 5, and 6. In such cases the expense of further examination may be saved.

Summarizing the foregoing practice, I rely on a key series for underground work, a modification of the key series for checking the assaying, and the use of the dummy. The checking of the assayer and the use of the dummy are not essential to detect salting, as stated, if the underground key series is properly employed. I maintain that the underground series unaided will detect salting, no matter how ingenious the attempt may be. With the key series even originals and duplicates can be salted and the fraud will be exposed because of the discrepancy in the averages. As stated, this is owing to the impossibility of re-cutting an original channel to obtain a duplicate so as to have both samples of the same weight. To salt successfully a key series, the salt would have to be introduced on a proportional basis; to do this, the relative weights of all originals and all re-cuts would require to be known. The proper use of the key series will fill a want infinitely more constant than merely protecting the mine-valuer from knavery. Formerly when conducting large examinations, there was always a thought in my mind that something might have gone wrong. The delegation of detail work to others injected this feeling of insecurity. With the proper application of the key series underground and its additional use to control the crushing and assaying departments, the engineer will know when the examination is completed that his sampling will stand the closest inspection.

The Upton-Thornton Oil District of Eastern Wyoming

The Upton-Thornton oil district lies on the western flank of the Black Hills, in eastern Wyoming, in Weston and Crook counties. The oil field itself is about 3 miles north-west of the town of Thornton, on the Chicago, Burlington & Quincy railroad. It is about 20 miles south-east of the Moorcroft oil field, 90 miles north-east of the Salt Creek oil field and about 80 miles due north of the Lance Creek oil field. An area of about 60 square miles, which includes the territory where the producing oil wells have been drilled and the adjacent country, has recently been examined by E. T. Hancock, of the U. S. Geological Survey, who has submitted a report on it for publication. The report is accompanied by a map showing the boundaries of the geologic formations, with contours showing the geologic structure, and cross sections showing the relations of the different formations to one another and to sea level.

There were 16 producing wells in the field when the examination was made, and 13 of these belonged to the Southwest Oil Co., which controls a large part of the field. The oil comes from a single steeply dipping sand, which is reached at depths ranging from 448 to 843 ft. The yield per well is low, averaging between 5 and 10 barrels a day. The oil is of excellent quality and has a specific gravity ranging from 0.820 to 0.826 at 15° C. It is taken by a small refinery belonging to the Southwest Oil Co., which supplies local trade with gasoline and other products. The oil field is not on an anticlinal fold but appears to be on a structural terrace, where the rocks dip much less steeply than they do in the surrounding area. An outcrop of the steeply dipping oil-bearing sand is only half a mile from the nearest well and a mile and a half from the most remote, a fact that not only permits a close study of the character of the sand but that helps to show the fallacy of the contention of some geologists that wherever an oil-bearing sand is exposed so much of its oil will escape as to preclude accumulation in commercial quantities near by. The extent to which the oil escapes, or its escape at all, probably depends on a change in the dip of the bed in which it is contained or on variations in the texture of the rock that forms that bed, as well as on the level of the ground water and other conditions, all of which are subject to considerable variation.

Within the Upton-Thornton district, but outside the proved field, there are two domelike anticlines which appear structurally suited to bring about accumulations of oil. One of these is called the Thornton dome; the other, the Upton dome. The oil-bearing sands in the lower part of the Graneros formation, which is commonly oil-bearing in this region, have been eroded from the higher parts of the Thornton dome, but they may yield oil in wells drilled far down the flank of the dome. However, it is possible that the deeper Minnelusa sand, of Carboniferous age, which is reported to contain oil in the Old Woman anticline, 75 miles to the south, may be present in this region, and wells should be drilled deep enough to test it before the dome is condemned as barren of oil. This dome has been drilled at two points, and the appearance of the sludge piles at the abandoned wells indicates that the drill entered the Triassic red beds.

The Upton dome is probably a less promising source of oil and gas than the Thornton dome, for it is much less pronounced, having a closure of but 50 ft., as against a closure of 500 ft. on the Thornton dome. In the Upton dome the sandstone in the lower part of the Graneros formation lies beneath about 150 ft. of Mowry shale, but it is thin and is not covered with a cap-rock sufficiently impervious to hold the oil.

Mine Accidents: English Speaking v. Non-English Speaking Employees

By ALBERT H. FAY

*The employment of non English speaking labor in American mines has been brought about by reason of the rapid expansion of the mining industry, beginning in the early 'eighties. The Americanization of this great body of labor, and its relation to accidents in the mining industry, are two problems of prime importance: the first as affecting citizenship and the growth of this Republic, and the second as an economic problem in mining costs. The former exerts an influence upon the latter, for the former implies education, social welfare, civic pride, and a general uplift to the ideals that America stands for. Ignorance, dirty and filthy living conditions, ill-health, disregard for law and order, discontent and lack of civic interest, lead to indifference and carelessness, perhaps the greatest of all accident causes. Eliminate carelessness and at least 50% of the accidents will disappear from industries.

IMMIGRATION TO AMERICAN MINES

During the decade previous to the year 1880 (as well as in earlier years), the greater part of the employees in the coal and metal mines were Americans or representatives of the English, Scotch, Welsh, German, and Irish peoples. The majority of the men of foreign birth had been in this country for some years previous to the great expansion of the mining industry which began at about this time. English-speaking miners continued to immigrate and to find employment in the mines in large numbers until about 1890. Since that year comparatively few immigrants from Germany and Great Britain have entered this industry, although Swedes and other Scandinavians have been constantly employed since the early 'eighties.

The employment, in the mining industry, of immigrants from southern and eastern Europe began about 1880. The Slovaks were the first arrivals and immigrated in considerable numbers. They were followed within a year or two by a few Magyars, and the number of immigrants of this race gradually increased each year. The Polish immigration began about 1890, although individual members of this people had been coming for a period of nine or ten years. After the year 1890 Poles and Slovaks arrived in great numbers. A few Italians were employed before the year 1895, but the immigration of this race did not begin upon a large scale until about 1900. They were at first engaged in railroad construction and maintenance-of-way work and gradually drifted into the mines. Croatians were employed in some districts before 1890, and Servians began to arrive in small numbers in the early 'nineties. The great bulk of all the immigration from southern and eastern Europe, however, has occurred within the last 18 years. Russians, Bulgarians, Rumanians, Ruthenians, Syrians, Armenians, Macedonians, Croatians, Servians, as well as Poles, Magyars, Slovaks, and Italians, have been among the recent arrivals. The races of southern and eastern Europe continued to come up to the time of the War, to find employment in the mines in increasing numbers in almost every important mining district in the Eastern states, and in the Lake district. Many of these recent immigrants have found their way to the Central and Western states. As a result of the rapid expansion of the mining industry, many mining communities have been founded, the population of which is largely made up of immigrants who have arrived during the last ten years.

The pioneer American, English, Irish, German, Scotch, and Welsh miners are thus outnumbered and their positions filled by the more recent arrivals. It is not difficult to account for this change, which is still going on. The former operatives and their descendents had opportunities to secure more congenial and safer work in other industries. Many of them advanced in the industrial scale, becoming foremen and attaining other responsible positions. Many also migrated to the Middle-West and Western states. Many of the former miners who left the industry entirely because of change in mining methods or the employment of immigrants entered mercantile, clerical, mechanical, or pleasant work of other kinds. Many of the business and professional men in the mining towns were formerly mine-workers. Their places were filled without difficulty with recent immigrants who were content with the wages and working conditions that prevailed at the mines. The wages paid in American mines seem very attractive to the recent arrivals of agricultural laborers from southern Europe.

FAILURE OF NATIVE-BORN TO ENTER THE INDUSTRY.

This racial displacement has occurred not only through the departure from the industry of the former employees, but also through the refusal of their children to enter the industry and the attitude of the parents themselves, who frequently discourage it. Of the total native-born, of fathers who were miners, a large percentage enter occupations other than mining. The conclusion from the limited data at hand, therefore, seems to be that while the foreign-born males of more than 16 years of age,

*An address delivered before the eighth Annual Safety Congress. Mr. Fay is mining engineer in charge of Accident Statistics for the U. S. Bureau of Mines.

whenever employed, work in the mines, the persons native-born of native fathers, together with the second-generation immigrants, are loath to enter the mines. This inference bears out in a large measure the experience of the mine operators, who state that the native-born and the second-generation immigrants are not entering the mines in the same numbers as formerly and that the industry is receiving a constantly decreasing number of employees of these classes.

There exists a prejudice against recent immigrants, which also operates to an important extent in the displacement of former employees. Many Americans, English, Germans, Scotch, Irish, and Welsh did not and do not desire to be associated in the mines with the recent immigrants, and the feeling has become prevalent that a sort of reproach attaches to an intimate working relation with the foreigner. The races of former immigration have, therefore, gradually left the industry and have entered other work, which, they feel, is more dignified and congenial.

The relatively small number of American miners who remain in the industry must work side by side with the recent immigrants. To a greater or less degree the standard of safety in the mine is set by the demands of the ignorant and inexperienced immigrant, not by the more intelligent American, and the standard of life is decided to a large extent by those conditions which will be accepted by the same recent immigrant. In short, in order to work in the coal-mining industry, the American must compete with the recent immigrant, who, as a rule, is not very particular as to the living and working conditions. These conditons, however, are in most cases far better than in factory towns, where congestion prevails.

Another effect of recent immigration from central and southern Europe has been the preventing of the English, Irish, Scotch, and German immigrant entering the mining industry. As already noted, these Western European races were coming to the industry in large numbers prior to the early 'eighties, but the number began to decline toward the end of the decade and practically stopped about 1893 or 1894. There can be no question but that the immigration of the Slovaks, Poles, Magyars, and other races operated to prevent the further coming of these older immigrants to the industry, precisely as it operated to drive out of the industry those already employed together with the native Americans. There is, therefore, no incentive for the English or German miner to migrate to the mining regions and compete with the Slovaks, Croatians, and Italians.

CITIZENSHIP

A point of general interest is the tendency on the part of different races of foreign birth to acquire citizenship, and their general interest in public and civic affairs. The recent immigrant manifests little real or intelligent civic interest. This may be ascribed to his ignorance of our political methods, his inability to read or speak English, the social and political aloofness of these races in the more or less remote mining villages, and their desire to avoid taxation. Those who reside in or near the cities seem to exhibit more interest than do those of the isolated communities. It seems that the Bohemians and Moravians, 94% of whom can read some language, take a much more active part in civic affairs than any other race of recent immigration in the bituminous districts of Pennsylvania. Among the other Slavic races, the Slovaks (82% read) and Poles (77% read) lead in this regard, while the Croatians (67% read) make the poorest showing. It is the general experience that this last race shows but little civic interest and that very few become naturalized. The Italians (81% read) are more active than the Slavic races in their efforts to become citizens, and appear to take a more active part in civic affairs. In cases where there seems to be encouraging civic activity it is nearly always due, not to their own intelligent efforts to attain citizenship and exercise its privileges, but to the influence of interested politcians, who in many cases may be a leader of their race; for example, an intelligent banker and steamship-ticket agent. It seems true of all the later immigrating races that they take far less interest in civic affairs than did the German (97% read) and English (98.5% read) immigrants.

The foreigner should be taught that the laws of America were made to protect, and not harass, every good citizen, rich and poor alike, and it is the duty of well-informed Americans to make this understood. If well-meaning foreigners, the making of good citizens, are left entirely to their own devices, they fall an easy prey to the designing I. W. W. and the Bolshevists. Somebody who understands their language fully, and in whom they have confidence, should explain to them that they are being deceived so long as they listen to anti-American propaganda.

CHURCH AND THE IMMIGRANT

The church association between the native Americans and the southern and eastern European immigrants is limited. The general attitude of the native churches toward the immigrant is one of indifference and there is a strong inclination in many communities to shun association with the immigrant in church activities. In many cases where missionary efforts are made by native churches of any denomination, services for the immigrants are usually held in barns, stores, or other unattractive places, thereby lessening the interest in them. The races from the southern European countries, which compose a large portion of the mining population, have been reared where there is no social caste in religious organizations, and have worshipped in buildings which are unsurpassed in beauty and grandeur the world over. When these people are offered services held in stores, barns, and similar buildings, their interest in the service naturally is less and they become indifferent. Lack of interest in church affairs tends to decrease activities in civic affairs. The church and its allied organizations can be an important agent in teaching these immigrants the rudiments of the English language and pointing out to them their duties as American citizens.

LACK OF MINING EXPERIENCE

Men of the races of the old immigration (Western Europe) have been employed in the mines of the United States for many years. As a result of their experience, both in this country and abroad, they are far better qualified as miners than are the southern and southeastern Europeans. The older immigrants speak English either as their native tongue, or, as in the case of the Germans and Scandinavians, because of long residence in this country. They may be treated in almost every respect upon the same basis as the American miners.

The employees of the races of the recent immigration, on the other hand, have been in the United States for so short a period of time that even though it be assumed that they have been employed in mining ever since their arrival, they must have had but a brief experience at most in the mines of this country. The data further show that very few of their number had mining experience abroad. Over 80% of the Scotch and English miners had mining experience in their native country before entering the American mines, while for the south Italian and Croatian less than 5% have had mining experience. Most of the latter were farm laborers in their native countries. Upon coming to the United States they decided to follow the occupation of mining because the work was better paid than any other obtainable, although many of them had been here only a few months and many more but a year or two. Under these circumstances it is not surprising that they know little or nothing of rock-formations, of fire-damp, of the properties of coal-dust, and of the handling of explosives—matters about which every coal miner should be thoroughly informed. To determine whether a piece of slate or roof is or is not likely to fall, often requires a considerable degree of experience, and the majority of the Slavs, Magyars, and Italians have not this experience.

IMMIGRATION IN RELATION TO MINING ACCIDENTS

The mines are presumably less safe than they would be with native American, English, Irish, Scotch, Welsh, or German labor, because recent immigrants often accept more dangerous working conditions than the first-named employees. Furthermore, the later immigrants are ignorant and untrained, and are a source of danger to themselves and to the other workmen. Among the older mine workers the feeling is strong that the employment of non-English speaking races has complicated the problem of safety in the mines. They assert that carelessness on the part of recent immigrants, and the ignorance of those who are suspected of having obtained their places without having had the required experience as miners, have tended to render the mines less safe and thus increase accidents.

A large proportion of the deaths and injuries reported for the coal mines of the United States occur among the non-English speaking miners. The employees consisting of the races of southern and eastern Europe, having had little experience in mining either in this country or abroad, are particularly liable to accidents, and as the responsibility for accidents rests in many cases with the men injured, to say that they are particularly liable to accidents is in effect to say that they are responsible for a considerable proportion of all the accidents occurring in the mines.

The mine accidents for which the workmen are themselves responsible fall naturally into two classes, those due to carelessness and those due to ignorance. As regards the first of these it is probable that the foreigner is no greater offender than the person of native birth. Many of the Americans and other English-speaking miners are undoubtedly reckless, and a large proportion of all the accidents occurring among their number seem to be due to this cause. Grave risks are often incurred for the sake of avoiding a little extra labor. Props are left unplaced, open lamps are used instead of closed lamps, cars are driven in a careless manner, explosives are handled recklessly—all in defiance of the most elementary rules prepared by men of long experience in the industry. Among the recent immigrants, on the other hand, many of the accidents are unquestionably due to ignorance, for by reason of their lack of experience, they do not see nor realize the dangers that confront them; nor do they readily comprehend the necessary precautions that must be taken to make their working places safe.

Lack of experience in the mines has a marked effect upon the high accident-rate as indicated by a study of accidents among the immigrants whose experience in mines, before coming to this country, was known. The fatal, serious, and non-fatal injury rates in the coal mines of Pennsylvania and West Virginia are approximately 14.5 per 1000, for those of whom 10% had mining experience prior to coming to the United States. The accident rate for those of whom 10-20% had mining experience is about 12 per 1000, showing a rapid decrease as mining experience increases. It would seem from this while experience is limited, these immigrants soon gain sufficient knowledge to use a certain amount of caution, thus giving a decline in accident rate.

As contrasted with the decrease in accident-rates among those of whom 5 to 30% have had mining experience, the accident rate based on similar data for those of whom 50 to 60% have had mining experience prior to coming to this country is 10.5, whereas the rate is 12 for those of whom 80 to 90% have had experience in the mines, a marked increase with the extra experience. This is largely due to the tendency of those with considerable experience to become more or less careless or reckless and to think that they can slight certain features of work without an accident. A new man entering the mine would not consider for a moment crimping a cap with his teeth, whereas many of the men who have been in the mines for 8 to 10 years would not hesitate and do not hesitate to crimp caps with their teeth. Other instances of carelessness might be cited. The available data, therefore, seem to indicate that inexperience is responsible for many accidents and that a little experience begets much caution on the part of the recent or new employee. As indicated above, there is thus a tendency toward a rapid reduction in accident

over-cautious, but he lacks experience. The seasoned miner has the experience, but too often caution is replaced by carelessness. Caution combined with experience will go far toward accident reduction.

Another element of danger is contributed by the fact that few of the recent immigrants speak or understand English, while almost none are able to read or write the English language, and placards of warning do not reach them. It is probable that the instructions of the mine bosses and inspectors are, because of this fact, frequently misunderstood. An inspector, for example, tells an immigrant miner, in English, of course, that his roof needs propping. The miner seems to understand, but does not, and a fall results. In some mines printed signs are used to indicate the presence of gas or other peril. These signs are quite unintelligible to most of the foreigners. A common language is absolutely necessary in every safety-first campaign. Accident rates are much lower in England, France, Belgium, Germany, Austria, and Japan than in the United States. In these countries but few foreigners are employed, a common language being used in each country. The difference in fatality rates cannot be entirely attributed to the lack of mixed languages, but certainly a large percentage of the accident reduction may be attributed to the 'common language' mines.

A comparison of accident rates with the ability of the miner to read some language or to speak the English language, shows that the ability to read, although it may not be English, has a greater influence on accident reduction than the ability to speak English. This may be accounted for by the fact that ability to read develops a higher degree of intelligence and places the employee in a better position to realize dangers more readily than one who cannot read. Furthermore, if he is able to read, he is more likely to heed danger signs put up in certain places.

The recent immigrant because of his lack of experience, his inability to speak English, and his keenness for earning money is often willing to work in places where more experienced or more intelligent men would refuse to work. For the same reasons he will frequently be satisfied with and accept mine equipment too defective for safety.

Comparative figures by occupations, based on the payroll of 10 typical coal mining companies in Pennsylvania, show that about 33% of the English-speaking employees are employed on the most hazardous of the mine occupations, hence one reason for the higher accident rate.

As a matter of fact, from trackman to loader, the English-speaking employees represent about 61% of the total, as compared with 82% for the south-eastern Europeans. These figures, therefore, indicate that the non-English speaking foreigner is employed in the most hazardous of the mine occupations, hence one reason for the higher accident rate.

ACCIDENTS BY NATIONALITY

In the Pennsylvania anthracite mines 43% of the employees are English speaking and this number is charged with only 28.8% of the fatalities, whereas the other 56% (representatives of continental Europe) sustained 71% of the fatalities. Likewise in the Pennsylvania bituminous mines the English-speaking employees represent 35% of the total and are charged with 27% of the fatalities, whereas the other 65% (representatives of continental Europe) are charged with 73% of the fatalities. As regards the figures for West Virginia the English-speaking employees represent 67%, and notwithstanding the fact that this includes 17% of colored employees, only 53% of the fatalities are charged to the English-speaking employees, whereas the other 33% sustained 47% of the fatalities. Almost the same ratio holds for non fatal injuries in the three groups of mines cited.

Had the fatality and injury rate for the English-speaking American been maintained throughout the three groups of mines, there would have been a saving of 716 fatalities and 900 very serious injuries, a strong argument for Americanization and education of the miner.

With the cession of Alsace-Lorraine to France, Germany loses the rich potash deposits of Alsace, and with them the potash monopoly of the world, according to the 'Vossische Zeitung'. The potash deposits extend 16 kilometres (9.94 miles) to the north of Mulhausen, over a surface of more than 180 square kilometres (69.2 square miles). They are unusually rich in potash salts, much richer in fact than the beds in the interior of Germany. They are, moreover, easier to exploit. Their thickness ranges from 3.7 to 5.4 metres (12.1 to 17.7 ft.). The thickness of the smaller beds in the upper layers varies from 0.8 to 1.5 metres (2.6 to 4.9 ft.). The first workings were begun in 1909; in 1913 there were 12 in operation. In a period of only three years the production rose from 42,420 to 287,000 metric tons, so that the production of potash in Alsace in 1913 was already one-fifth of the entire German output. The total capital invested in the potash work of Alsace amounted to 34,400,000 marks ($8,187,200 at normal exchange). The production of these workings, it is calculated, would supply the world's requirements of potash for 250 years on the basis of the consumption in the last pre-war year. According to estimates made by Dr. Paul Kessler, the quantity of potash salts in Alsace amounts to nearly 1,500,000,000 metric tons, from which several hundred million tons of pure potash can be extracted. Before the War Germany exported potash salts to the value of about 100,000,000 marks ($23,800,000 at normal exchange). This exportation will undoubtedly be multiplied in the next few years in consideration of the enormously increased world demand.

REVIEW OF MINING

FROM OUR OWN CORRESPONDENTS IN THE FIELD

ARIZONA

NEW SHAFT OF COPPER QUEEN PROGRESSING—SALE OF PROPERTIES OF THE SHANNON COPPER CO.

BISBEE.—Subsidence of the ground around the hoist at the Czar mine, causing cracks to appear in the surface, has caused the Copper Queen branch of the Phelps Dodge Corporation to announce that the hoist is to be leveled. The Czar is one of the oldest mines in the Warren district. The Holbrook shaft, adjoining the Czar, is several feet out of alignment but this will not require immediate adjustment. During the time the Czar hoisting equipment is being leveled, men will be lowered through the Holbrook and the Queen incline.

The new Southwest shaft of the Copper Queen is progressing rapidly. It is being raised from the third level of the Southwest workings to the surface, a distance of about 700 ft. The collar will be between the present office of the Southwest mine and the Uncle Sam shaft. The raise is being carried on simultaneously on the third and seventh levels, while station-cutting is in progress on other levels. The present Southwest shaft extends from the Czar 200-ft. level to the sixth level of the Southwest, and is equipped with an underground electric hoist on the fifth level. Hoisting is done through a five-foot compartment, equipped with a single-deck cage. For several years there has been no mining below the third level, while operations on the upper levels have extended several thousand feet from the present shaft. The new shaft will eliminate long hauls and provide adequate hoisting equipment; it will consist of one large hoisting compartment and a smaller compartment for a manway.

A drift is being driven from the Gardner 1000-ft. level toward the Czar and Holbrook, and will be of value in exploring the vertical extent of the orebodies in the Holbrook and Czar zones. The heading of this drift has advanced to a point 2000 ft. from the shaft. The ground being explored is 400 ft. below the lowest workings of the Holbrook and 600 ft. below the lowest Czar working. The face of the drift is in the lower limestone, below the usual ore horizons of the district, so its progress is being watched with much interest. At the Lowell shaft of the Copper Queen interesting work is under way on the 1300-ft. level, re-opening part of a large orebody, originally encountered several years ago, but abandoned on account of fire. The sulphide ore was ignited by means of heat generated by friction caused by ground movement and it became necessary to seal off a large area by concrete bulkheads. Water also has been kept constantly running through the fire zone and it is now possible to recover a large tonnage of high-grade ore. This will be accomplished by construction of concrete bulkheads and carefully planned fire-doors to control gases from that part of the orebody where the fire still is active. On the 1400-ft. level of the Lowell two new drifts have been started, one heading toward the Gardner shaft, and the other below the known orebodies on the 1300-ft. level. Connection between the Lowell and Gardner already has been made on the 1000, 1100, and 1200-ft. levels. The 1300-ft. connecting drift has been under way for some time, and with the new 1400-ft. connecting drift it should determine the extent of a large body of sulphide ore that already has been stoped to a vertical depth of several hundred feet. The other 1400-ft. level drift is at present in primary sulphide ore that probably connects with the known orebodies on the level above.

A winze is being sunk from the 1600-ft. level of the Sacramento shaft to the 1800-ft. level, 200 ft. lower than the present deepest workings of the Copper Queen. Directly over the collar of the winze a raise is being extended to the 1500-ft. level, giving the completed winze a depth of 300 ft. The winze consists of two vertical shaft-compartments, one for hoisting, the other for piping, manway, etc. It will be equipped in the 1500-ft. level with machinery for hoisting to handle supplies and waste from prospecting work. This work is being carried on as part of the plans for the new haulage system having the Dallas shaft as an outlet. This will be in operation by the time steam-shovel operations on Sacramento hill make abandonment of the Sacramento shaft necessary. The Sacramento shaft at present handles almost the entire tonnage from the Copper Queen mines. By the time the winze has been completed to the 1800-ft. level, the Dallas shaft also will have been sunk to that depth. By driving from both shaft and winze the time required for connection will be cut in half. Besides acting as a haulage-way, the new drifts will furnish a base for prospecting and developing orebodies below the 1600-ft. level of the company properties, about which little is known at present.

CLIFTON.—It is understood here that the sale of the properties of the Shannon Copper Co. was completed at a meeting of stockholders, held in Boston, Massachusetts, October 7, the purchaser being the Arizona Copper Co. As a quorum was not present at the regular stockholders' meeting the adjourned meeting in Boston was called. The exact figure in the deal is not made public, but it has been stated in authoritative quarters that after liquidating all obligations the Shannon company will have left a

balance of about $450,000 to be used in development of its mines at Gleeson, Cochise county, and Yeager canyon, in Yavapai county. The Yeager property has shown some rich ore but still is in a problematical stage. The Gleeson property, which cost the company $80,000, has sufficient showing to warrant it being valued at $600,000 at the present time, and ore from this property has been used by the Shannon for a considerable period to carry on its operations. According to Nathan L. Amster, president of the Shannon Copper Co., the sale of the Clifton-Metcalf property to the Arizona Copper Co. marks the parting of the company with the least valuable of its holdings. The Gleeson property has large bodies of low-grade copper, but it is believed sufficient reserve will be developed there to warrant the establishment of a mill and smelter. J. W. Bennie, general manager for the Shannon company, now is at Gleeson, pushing development work.

COLORADO

ASPEN, CARIBOU, LEADVILLE, CRIPPLE CREEK.

Universal interest in the search for petroleum sustains efforts at discovering new oilfields in Colorado. Search is being made in various parts of the State and wells are being drilled in territory even that has been unfavorably passed upon by the State Geologist. A good many wells have been drilled in Rio Blanco county, north-western part of the State, by subsidiaries of large oil companies, and rumor states that these wells are carefully capped when completed, the inference being that good results have attended the drilling of a good proportion of such wells, production from which must await completion of refineries and the building of railroads. Recently wild-catting is being done along the valley of the Fountain river between Colorado Springs and Pueblo, there being confidence among certain oil-men that the geological conditions are there analogous to those that furnish petroleum in commercial amounts at Florence and Boulder.

In the case of certain demands made by about six hundred smelter workers of Pueblo upon the State Industrial Commission, this commission granted wage increases of from 25c. to 40c. per shift, but rejected several demands such as recognition of the union, time and a half for overtime and holiday labor (based upon the eight-hour shift), weekly paydays, the establishment of seniority rule in hiring and discharging men, the abolition of physical examinations required by employers, and the abolition of the contract, bonus, and additional-pay plan practised by the Pueblo smelter.

ASPEN.—After a long period of quiet, this district is receiving considerable notice through occasional strikes of silver ore. As is well known, Aspen is famous for its rich silver mines of the past. Some time ago we learned of a splendid find in the old Oakland property and the report was substantiated. Recently attention has been directed to a strike in the Mary B., one of the oldest claims in the district. These finds have done much to revive interest in this area and the prospecting of both old and new properties is being pushed vigorously.

SAWPIT.—The Colorado Vanadium Corp. is rapidly completing its new mill near Sawpit, a few miles north-west of Telluride, and expects to be operating very soon upon vanadium ores from its extensive holdings in the vicinity. The ore occurs in sedimentary beds on cliffs.

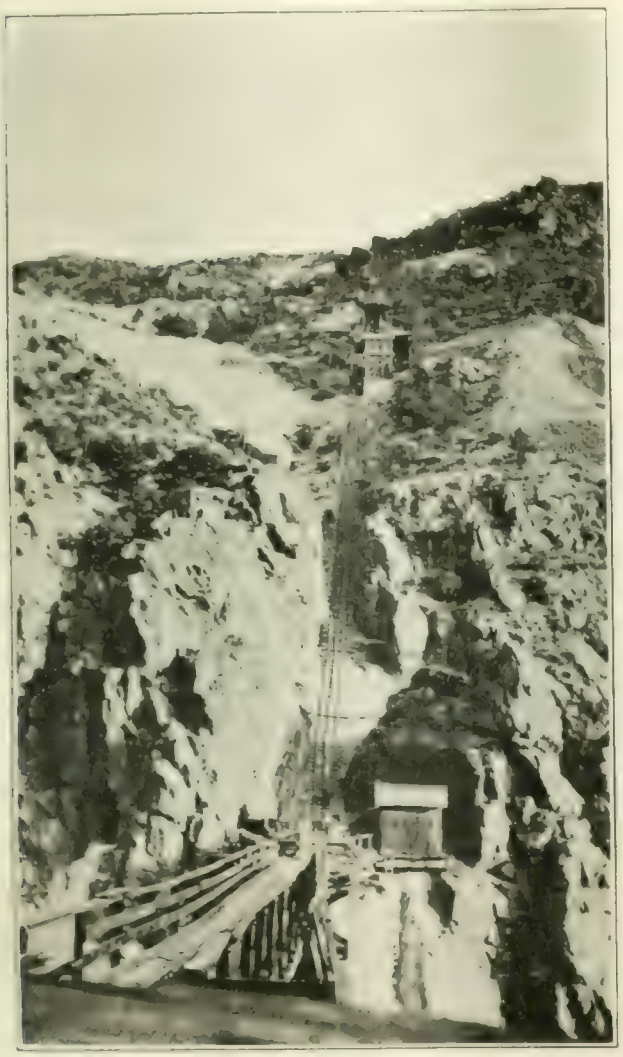
CARIBOU.—This district, in which the first discovery of silver in Colorado was made in 1869, after submitting to adverse metal-market conditions for many years, is showing substantial activity. The Caribou mine itself, with a production record of $7,000,000, is being worked by numerous sets of lessees, the Potosi mine is shipping regularly, the Congo Chief is continuing its deeper development while saving a good grade of silver ore for anticipated higher prices for the metal, and many prospects are being worked. During slight excavation work within the town of Caribou, in that portion that was burned to the ground years ago, a vein of silver ore was recently disclosed. The Grand county group is being equipped with a small electrically driven surface plant. In the Ward district, a few miles north of Caribou, Ewing & Company have completed and begun the operation of a new concentrating mill that handles run-of-mine ore from the famous White Raven mine, strictly a silver producer.

LEADVILLE.—One of the first complications to arrive out of the recent decision by Judge Hersey in the district court at Leadville regarding the moving of the boundary line between Lake and Summit counties is over the collection of taxes for the year 1919. All tax assessments for this year on the molybdenite properties at Climax were made by the Summit county officials. Since the court decision the attorney for Lake county advises the assessor for that same county to effect a transfer of the assessments from Summit county to Lake county. Before attempting such proceedings, however, the Lake county assessor referred the matter to the State Tax Commission, which in turn referred it to the State Attorney-General. This last authority renders the opinion that the present tax assessments may not be interfered with for the year 1919, especially as the case is not settled for good, it being probable that it will be re-tried. Litigation may continue to affect these tax affairs for a long time, since Summit county will not quietly relinquish valuable land that it has held without previous dispute since pioneer days.

CRIPPLE CREEK.—Predictions made by many early prospectors of the Cripple Creek district seem recently to have been given some degree of substantiation. This refers to a surface discovery on Carbonate hill, which borders the rim of the great crater on the north. A portion of the hill is breccia, but the greater portion is granite. One or two mines on the southern side have produced ore. Just as mineral values were found to extend outward from the crater into the adjacent country rock (granite) to the south in the Independence mine and also, in lesser degree, at other points around the rim of the crater, it may be that developments in Carbonate hill will disclose considerable orebodies.

The old and well-known Isabella mine, during the

active speculation that formerly prevailed in Cripple Creek stocks, was for years used as the basis for numerous stock-jobbing schemes. Owing to the relative inactivity of this mine for some time past, a movement has been started by stockholders to interest a sufficient number of such stockholders in the proposed Isabella Leasing Co., to be capitalized at $25,000 with shares at one dollar par. Capital derived from disposal of this stock will be devoted to development of new ground. Ore produced by the leasing company will be charged royalties ranging from 8% to 30%, depending upon grade of shipments.



KING INCLINE, ARIZONA COPPER CO., METCALF, ARIZONA

MICHIGAN

POSSIBILITIES OF RECOVERING COPPER FROM OLD SMELTER SLAG.—DEVELOPMENTS ON THE MAYFLOWER LODE.

Experiments made at the Michigan College of Mines show that it is possible to save copper now lost in the slag that is run to waste from the smelters operating in the Michigan copper district. The slag of the Quincy Mining Co.'s smelter, at Hancock, has a copper content of 22 lb. per ton. There is 100,000 tons of slag on this dump. Experiments performed on this slag show that 18 lb. is metallic copper, recoverable with practically no difficulty by ordinary wet concentrating methods, after being ground. Similar experiments conducted on the slag of the Michigan Smelting company, which treats the product of the Champion, Trimountain, Baltic, Wolverine, Mohawk, Michigan, and other mines, and with the slag at Hubbell, where is situated the Calumet & Hecla smelter and the furnaces that treat the product of the subsidiaries of that corporation, illustrate a similar saving is possible, although the untreated slag does not contain quite so much copper. In the slag pile at Dollar Bay, not now in operation, but containing the accumulations of years from the old Lake Superior Smelting Co., 20 lb. of copper per ton is averaged. It is not to be understood that any such losses in copper now are permitted; on the contrary, refining has been improved to such an extent that it is doubtful that further improvement is possible. The old slag piles, however, were formed from blast-furnace operations in the days when copper-smelting was not as well understood and requirements were not so exacting as they are at the present time. These slag piles are small in comparison with the great Calumet & Hecla sand pile, which today is yielding a larger profit per ton of material handled than any mine in the district; nevertheless their re-treatment offers attractive possibilities for profit.

From a geological standpoint the developments in the shaft at the Mayflower-Old Colony property present interesting chances for speculation. The formation in the shaft at 1560 ft. proves that the lode was cut at 1403 ft., an assumption that could not be verified previously. Shaft-sinking will continue to 1700 ft.; then the lateral work on the lode will start in two directions at 1403 ft. The confirmation of the theory that the Mayflower lode was cut at 1403 ft. indicates possibilities that copper may be found outside of the accepted limits of metal formations in this district. In addition to the expectation of commercial success for the Mayflower corporation itself, the work is likely to stimulate exploratory operations for such properties as the St. Louis and the Centennial, both of which carry the same formation. The shaft openings prove the flatness of the lode and make it, from present indications, a mining proposition that will be easily handled. The so-called Mayflower lode was opened in two places with the diamond-drill, one at 1400 ft. and one at 1700 ft., the lower opening being the richer. The drill results showed faulting, which is confirmed by the shaft work.

The close association of mining and taxpaying is illustrated in the case of the Baltic Mining Co. v. the Township of Adams, County of Houghton, argued before the Supreme Court of Michigan last week and likely to be decided in the near future. The case was started when Fred W. Denton was general manager for the Copper Range Co., of which the Baltic is a subsidiary. Mr. Denton started the suit as a protest against the taxes levied against the Baltic. Mr. Denton was not only manager of the mine but supervisor of the township. The case was won by the township in the local circuit court and was appealed by the mining company. As super-

assay of the township. Mr. Denton had to arrange for the defense of the suit as well as the prosecution. The case is looked upon as friendly to determine the justice of the taxation methods employed in the county of Houghton, where valuations for mining properties are reached through the utilization of the stock market figures of the Boston exchange.

NEVADA

SHAFT OF FAIRVIEW EXTENSION INTERSECTS GOOD ORE—CRACKER JACK TO BE GIVEN LEASE ON PART OF FLORENCE DIVIDE BLOCK.

ROUND MOUNTAIN.—The shaft of the newly organized Fairview Extension company at a depth of 65 ft. is in ore assaying over $25 per ton. A hoist and air-compressor are in place and the power-line has been completed. The Extension claims adjoin the Fairview and the shaft is one mile from the Fairview mill. The Sunnyside mill is working on ore produced by lessees, who recently secured an extension of their leases to January 1, 1920. Two Huntington mills are being operated two shifts and are treating 20 tons of high-grade ore daily with an extraction of 98%. The grade of ore being treated makes it necessary to run the mills slowly. The Fairview mill is operating 6 stamps, using three shifts, and is treating 30 tons daily, the usual amount. Quartz of promising appearance has been found in a drift driven 100 ft. south-east from the bottom of the 250-ft. shaft. Placer mining has been discontinued for the winter and a new pipe-line is being laid for increasing the output next season.

TONOPAH.—According to reports the Cracker Jack is to be given a lease on part of the Florence Divide block by the Florence company after January 1. The Cracker Jack is to secure territory near the Florence Divide stopes and on the strike of the vein and it is understood the remainder of the lease will be renewed to the Florence Divide if application is made, but on terms that will provide for more development work than has been done in the past. As far as can be learned the Cracker Jack lease will be on territory entirely outside the Florence Divide ore-shoot.

ARROWHEAD.—What is believed to be the extension of ore found on the 100-ft. level of the Arrowhead has been opened in the east drift on the 175-ft., or bottom level. The material assays $200. Six feet of ore is exposed in the west drift on this level and ore assaying over $2000 per ton is being mined in the winze from the east drift on the 100-ft. level.

GOLDFIELD.—On November 1 repairing of the Great Bend shaft was started. It is estimated this will require

NEW MEXICO

three miles from the Hurley concentrating plant of the Chino Copper Co., recently was incorporated under the laws of New Mexico for $150,000, shares having a par value of 10 cents. One-third of the ownership stock is held in escrow while the remainder will be used as a development fund. Company offices have been established at Deming, New Mexico, in charge of H. W. Loomis. Officers of the company are C. A. Overlock of Douglas, Arizona, president; D. A. Richardson, secretary; H. W. Loomis, treasurer and manager. All three are directors. The incorporation of the company marks a step in an attempt to revive this once rich silver mining district, where mining has been done intermittently since 1860. Pinos Altos had about 100 men washing gold when the Civil War broke out. A ring of silver camps, once active but closed down since the silver slump of the early '90s, surrounds Lone Mountain within a radius of 20 miles. These include Georgetown, Camp Fleming, and the Bremen mines at Silver City, which made that place, as well as a number of less notable ones. All these mines produced high-grade silver in bygone days. Few, if any, had any real development work done; the old-timers gouged out the ore where it was exposed at or near the surface. Lone Mountain was classed as a rich producer of this type, having given up many thousands of dollars worth of ore from surface pockets. Reasoning from analogy with mining camps of South America and Mexico, particularly in the latter country, and based upon reports of the U. S. Geological Survey, the Lone Mountain company has decided to explore its property at depth on the main porphyry intrusion into the lime, where large quartz bodies indicate a continuity that the small pockets in the lime do not show. The shafts will be dry to reasonable depths and sinking will be inexpensive in the soft porphyry. No timber will be required beyond the collar at the surface. There is a good truck-road from the Hurley station to the mine. Mr. Loomis first owned the ground in 1884, but later abandoned it, until recently when he had an opportunity to recover it.

DEMING.—A discovery of silver-lead has been made in Tres Hermanas mountains between Deming and Columbus. Details of the strike are lacking except that the property on which it was made adjoins that of J. A. Mahoney of this city.

LORDSBURG.—The 85 Mining Co. has been replacing part of its power-plant equipment of Diesel engines with steam-turbines in preparation for starting up its mill after a long shut-down. The company continues to ship its high-grade ores to the C. & A. smelter at Douglas for reduction.

GOLD HILL.—A company has been organized by Mr. Lorenz and other El Paso business men to operate this old property, lying between Lordsburg and Silver City. No definite announcement of plans has been made, although it is understood an extensive development campaign is planned and operations on a limited scale have been started.

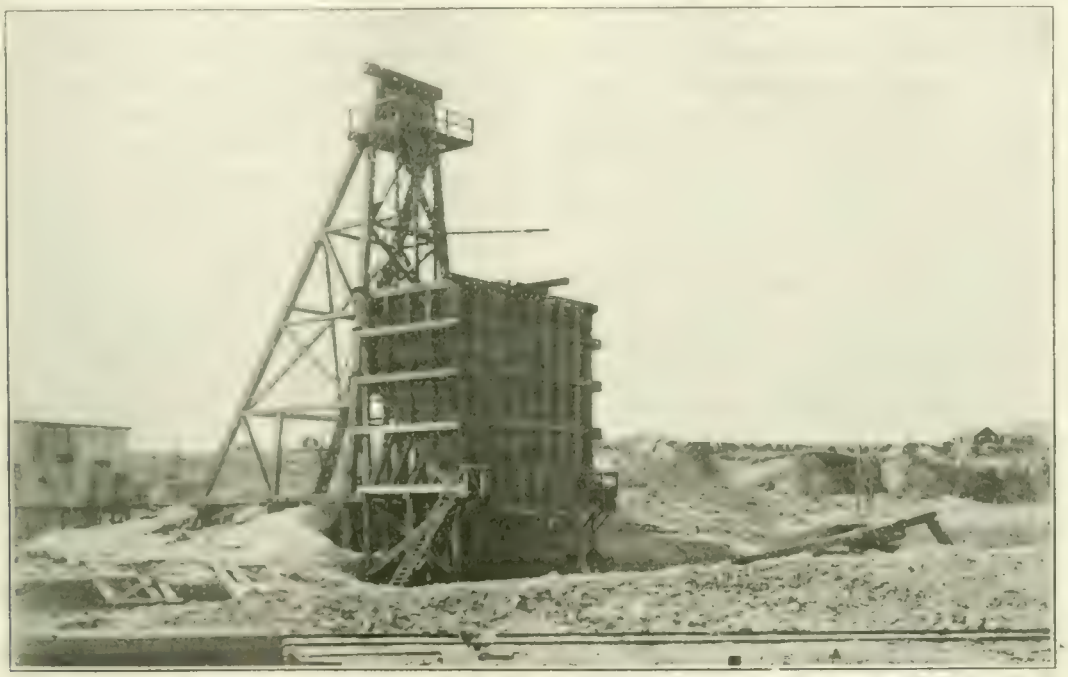
to Lone Mountain and north to Tyrone. Many of the properties taken up are former silver producers which with silver prices at their present level can be made to produce at a profit. Re-opening some of the old producers is assured in the near future. Mining men investigating this district have laid special stress upon the possibility of low grade orebodies, rejected by the old-time miners, but which with modern mills could be made to pay handsomely.

UTAH

EFFECT OF THE COAL STRIKE ON ACTIVITY IN THE TINTIC DISTRICT.

SALT LAKE CITY.—Impending labor trouble in the coal mines of the State is already affecting the metal-mining industry. In several of the metal-mining camps operators have been notified that practically all the railroad cars will be sent to the coal mines during the last week of October and that but few cars will be available for hauling ore. This order has already cut in heavily on the output of the Tintic and Park City mines in particular. If the strike should spread to western coal mines, it is more than likely that it would eventually tie up the smelters and then in turn all the producing mines. Railroad representatives in some of the camps have notified the mine operators that only such cars as are sent into the districts loaded will be available for the shipment of ore, and there is even a likelihood of these cars being hurried back to the coal mines instead of being used in moving ore to the smelters. It is stated that the coal mines of Carbon county employ about 4000 miners, 25% of whom are organized, while labor leaders state 50% are organized. Coal operators held a meeting with Federal and State officials in Salt Lake City on October 29, at which it was decided that the mine operators will continue operations and do everything possible to keep the people of the State supplied with fuel. Hardon Bennion, Secretary of State, and acting Governor during the absence of Governor Bamberger, said the State officials are fully cognizant of the possibilities of the situation and are keeping in close touch, and that the State authorities will lend their support toward keeping the mines in operation, and are making preparations to meet any emergency.

ALTA.—Approximately fifteen feet of snow fell here during the storm of October 26 to 27. Mining operations have been seriously hampered and the Little Cottonwood Transportation Co.'s railroad, which transports ore to the valley smelters, was completely tied up for several days. Operations were recently resumed at the Cottonwood Metals mine in Big Cottonwood canyon. An adequate supply of materials has been laid in for the winter and development work will proceed without interruption. This company owns 32 claims in the heart of the Big Cottonwood mining district. The main adit is now in 1071 ft., and has already cut four fissures. At present a drift is being driven to follow a promising shoot that was uncovered in one of the fissures. Samples from this shoot average $55 per ton. The vein will be followed until the intersection of the fissure with the lime-quartzite contact is reached. The company is employing two shifts per day, and if no unforeseen contingencies arise to prevent steady work before the winter is over, several of the most important fissures should be cut by spring.



THE MAIN SHAFT OF THE GOLDFIELD DEVELOPMENT CO., GOLDFIELD, NEVADA

BINGHAM.—Announcement has been made that the Bingham & Garfield Railway Co. has taken over from the Denver & Rio Grande Railroad the ore-hauling contract which the latter road has had with the Utah Copper Co. for a long period. The contract the Rio Grande company had with the Utah Copper Co. provided that the Copper company deliver to the railroad company 7500 tons of ore

per day for transportation to the Magna and Arthur plants. Coincident with this announcement it was stated the Rio Grande would reduce its forces 30 men at Bingham and 70 at Welby. The above arrangement is temporary and was made for the purpose of giving the Rio Grande more cars for the hauling of sugar beets and coal. The Bingham & Garfield Railway is now handling practically all of the ore from Bingham mines to the valley mills and smelters.

EUREKA.—There is considerable activity in the eastern and southern parts of the Tintic district at present, no less than 20 new shafts being sunk. At the Little May property in South Tintic, new equipment has been installed and a depth of 130 ft. has been reached. At the Alaska property, immediately adjoining, a discovery of ore was recently made, carrying from 30 to 200 oz. in silver per ton. Good progress is being made in the erection of a new hoist and electric motor at the East Tintic Coalition mine. The compressor has not arrived, but is expected daily, when mining operations will be started. The Eureka Bullion is putting in a water line which will connect with the line supplying the Eureka Lily and the Big Hill properties.

Shipments of ore from the district for the week ended October 24 totaled 120 cars. The shortage of cars, caused by the sugar beet and coal traffic, is now being felt by all of the large producers.

A new station is now being cut on the 1450-ft. level of the Tintic Standard mine, this being the preliminary step toward the development of the big ore-deposits at an additional depth of 100 ft. As soon as the station is completed, at least two drifts will be started for the purpose of getting beneath the present large stopes. The ore that was recently found a short distance toward the south-east of the shaft on the 1350-ft. level is responding splendidly to development work, and is now one of the mine's largest stopes. Officials are much pleased with recent developments, and by the time the railroad spur reaches the mine, all the new equipment, including a large compressor, will have been placed in running order. This mine is the second largest silver producer in the State, and one of the heaviest lead producers.

PARK CITY.—Shipments of ore from local mines to Salt Lake valley smelters for the week ended October 24 were as follows: Ontario Silver, 485 tons; Silver King Coalition, 442 tons; Judge M. & S. Co., 110 tons, Silver King Consolidated, 55 tons; and Daly Mining, 54 tons. There has been an unusually heavy fall of snow, which has seriously interfered with mining and development operations. The impending coal strike has also resulted in shortage of cars for ore loading.

At the Iowa Copper property, excellent progress has been made with the installation of new equipment. The contact has not been cut as yet, but from indications it cannot be far distant. Development work at the Glen Allen property is yielding encouraging results. In the main tunnel winze, which was recently unwatered, from 5 to 8 ft. of ore has been opened up. The management is making every effort to complete the mill and is confident that operation will begin before severe weather sets in. At the Park-Utah mine development is progressing satisfactorily. On the south drift, three fissures have been cut, the intermediate one being highly mineralized.

WISCONSIN

GENERAL NEWS OF THE DISTRICT.

HIGHLAND.—The Saxe Mining Co. of Milwaukee, operating the Lampe mine, has resumed operations after a shut-down of more than six months. Low markets compelled the suspension of mining operations. The Saxe management recently disposed of several hundred tons of zinc carbonate ore carried in bins since the shut-down, and a force of miners has been returned to underground work.

LINDEN.—Two new companies are engaged in this district, after a shut-down lasting several months. The Fearless Mining Co. has been incorporated with a capital stock of $100,000. The incorporators are Frank Harker, Huntington & Weller, Jos Piquette et. al., of Platteville. A new 100-ton mill has been completed and is in action. The main orebody is opened on a working face 60 ft. wide with sides undetermined, and from 8 to 10 ft. in thickness, all high-grade 'jack'. The first recoveries, in milling, show a concentrate assaying 55% zinc from the jigs. The Mackay Mining Co., recently incorporated, has taken over the holdings of the Ross Mining Co. The incorporators are D. Mackay and W. MacKay of Platteville, and J. Dunlavy, of Milwaukee. The Ross equipment has been put in shape for milling and men are at work underground driving to recently discovered zinc deposits on the W. Vial land, adjoining the Ross fee, to the east.

MINERAL POINT.—The Mineral Point Zinc Co. has enlarged its operating program, heavier buying of zinc ore from independent operators featuring recent business. Receipts of raw ore run about 40 cars of zinc concentrate weekly. The reduction works treating these ores operate on constant schedule, and from 500 to 600 tons of premium-grade blende is shipped weekly to the smelters of the Mineral Point Zinc Co. at DePue, Illinois. Large shipments of zinc oxide are made weekly and deliveries of from 3 to 5 cars of commercial sulphuric acid leave the works frequently. The company's leading producers in the field are the zinc carbonate mines at Highland; the Hoskins and Penna-Benton, at New Diggings; the Coker No. 1, at Livingston; and the Marsden mine at Pilot Knob, south of Galena, Illinois. These mines average from 25 to 30 cars of zinc ore weekly.

PLATTEVILLE.—The Block-House Mining Co. (Kistler-Stephens, proprietors,) have on hand 30 cars of high-grade blende, 4 cars of which were marketed on October 27 to the American Metal Co., Langeloth, Pennsylvania. About 1000 tons of green concentrate is held in bin awaiting treatment. The mine and mill have been shut-down for several months. The recent upward trend of the ore market has encouraged operation and the plant is ready to resume work on short notice.

BENTON.—Deliveries of zinc ore from this district, at

this writing amount to 45 cars of raw ore weekly, most of which is diverted to the uses of the reduction works in the immediate vicinity. Leading producers are the Champion mine, owned by the Wisconsin Zinc Co., with an average of 9 cars of zinc ore weekly, and the Hoskins mine, owned by the New Jersey Zinc Co., with from 7 to 10 cars weekly. The Frontier Mining Co., another of the active mining corporations engaged in this district, is reporting weekly deliveries from the Bearcat, Bull Moose, and Middie mines. The Skinner Roasters, operated by the Wisconsin Zinc Co. for the treatment of low-grade concentrate, are running night and day. Deliveries are made in open market to the highest bidder and run from 10 to 15 cars, premium-grade blende, weekly, receiving top prices for zinc ore paid in this field. Recent assays of ore converted at this plant run as high as 63% zinc. Attempts by agitators, representing the I. W. W., to organize the miners of the district met with signal disaster. Local authorities took an active hand in the prompt removal from the field of these disturbers, and those who contributed to the I. W. W. and subscribed to its policies were promptly dismissed. Public sentiment in the district and among the native miners is strong against interference. They feel that the workmen are well paid and have good hours and working conditions, and that they require no outside assistance.

BRITISH COLUMBIA

TRANSPORTATION DIFFICULTIES IN THE SALMON RIVER DISTRICT.—NEW SHIPPERS TO THE TRAIL SMELTER.

STEWART.—The survey of the proposed Government extension of the Premier wagon-road to the Big Missouri mine has been completed, according to James P. Suttie, who had charge of the work and has returned to Stewart. It is expected that the work will be started early next season and that it will be completed during the summer. This will facilitate the shipment of ore by such properties of the Salmon River district as the Big Missouri, Forty-Nine, Unicorn, and others. While there may be trial shipments from some of these properties this winter it is not thought that much ore will be sent out. The only regular shipper in the district this winter will be the Premier. It is understood that snow motors now are being built for the company and that they will arrive soon. Just how much ore it is planned to ship is not known but there is a considerable quantity on the dump. The Premier road is almost completed and when the snow comes it will be in first-class condition compared with that of last year over which two shipments were made, the returns from which totaled $168,000.

A small shipment of high-grade ore has arrived at Hyder, Alaska, which is close to Stewart, from the Forty-Nine mine. It is said to rank among the finest ore the district has produced and is expected to average $1000 per ton. H. Howson, who is in charge of the work, is enthusiastic with the showing developed. The diamond-drill work, now in progress, is reported to have demonstrated that the Forty-Nine is likely to become a producer of importance.

The mineral zone of the Salmon River district is handicapped because of its situation. The rugged mountain range dividing Alaska from British Columbia forces the export of ore through American territory to Stewart, whence it is loaded for the smelters or concentrators. Representations have been made to the Canadian government that a railroad be constructed to provide a ready outlet for the mineral riches of the country. The reply, it is understood, has been that it is impracticable to build such a road because, as matters stand, it would mean that part of the road would have to traverse American territory. Naturally, on the other hand, the American government would be scarcely likely to undertake the work to take care of a Canadian output. Consequently the project, which is considered of first importance to prospectors and mine operators, has fallen back to the shoulders of the latter and everything possible is being done to induce Sir Donald Mann, who is interested in the Big Missouri, and his associates to take up the task and to make a start next year.

ALICE ARM.—Shipments from the Dolly Varden mine to the Anyox smelter of the Granby Consolidated Mining & Smelting Co. have been closely inspected by mining men at Anyox, who are reported to be favorably impressed. It is felt that the Alice Arm district of British Columbia has an assured future as a mining centre. Important developments are looked for with the completion of the plans of the Taylor Mining Co. in regard to its railway which, it is understood, is to be extended to the Wolf mine, another silver producer some distance farther inland than the Dolly Varden. The railroad now is handling a limited quantity of ore daily, but with additions to the rolling stock and general improvements its tonnage capacity will be materially increased.

STUMP LAKE DISTRICT.—In the course of the last few months this district has been visited by Charles Camsell, of the Canadian Geological Survey; Mr. Week, a mining engineer connected with the Bunker Hill & Sullivan Mining & Smelting Co., operating in the Coeur d'Alene, Idaho; and other mining men. Interest centred chiefly in the work of the Donohoe Mining Corporation in the unwatering of the Joshua mine workings and the provision of the equipment necessary to place the property on a producing basis. The old Mary Reynolds mine, on which development work has been in progress for some time under the supervision of R. R. Hedley, also was inspected. With reference to the Joshua mine it is announced that the first mining operations will be on the 300-ft. level, water now having been cleared to a depth of 380 ft., and that shipments are expected to be made before long. As to the Mary Reynolds it is stated by Mr. Hedley that the showings are encouraging. He has made a shipment of 45 tons to the Trail smelter and asserts that the new road to the property, in the construction of which financial assistance was tendered by the Provincial government, has resulted in a considerable economy in the matter of transportation.

TRAIL.—No fewer than six new properties make their appearance in the last list of ore receipts at the Trail

smelter of the Consolidated Mining & Smelting Co. of Canada. With the exception of the Sovereign, which is one of the properties operated by Clarence Cunningham in connection with his reduction plant at Alamo, B. C., the new shippers are for the time being minor properties under development, and all qualify in the silver-lead-zinc category. The list includes the Freddie Lee, which is being developed by A. W. McCune, and the Ocean at Sandon, the Little Phil and the Tariff, at Ainsworth, and the Zincton in the silver-lead-zinc belt of the Sheep Creek district.

Grand Forks.—The Molly Gibson Mining Co., operating about four miles from Paulsen, has intersected ore assaying from $48.50 to $125 per ton in the lower tunnel of its workings. There is 60 ft. of stoping ground and the work of development is proceeding energetically. It is understood that steps are being taken to provide transportation facilities, it being the intention to start regular shipments as soon as possible.

MANITOBA

The Pas.—There has been considerable activity in this district of late, due to the new finds on Copper Lake and the probability of the Flin Flon sulphide mine starting operations this coming winter. Several engineers have been at Flin Flon planning underground development work to check up the diamond-drilling which was done during 1916 and 1918. It is understood that Hayden, Stone & Co. interests have taken the option. To proceed further after checking up drill-holes would mean a 72-mile railroad from The Pas, about 35 miles of electric power line and a smelter for the massive sulphide ores. At Herbe Lake the property of the Northern Manitoba Development Co. has been sold. This property has a mining plant installed and two years ago shipped two carloads of high-grade ore to the Trail smelter. From the Mandy mine, 8000 tons of ore was hauled over the ice last winter to the head of navigation at Sturgeon Landing. From there it was floated down to The Pas on barges last summer, and shipped to the Trail smelter. Due to low water on the Saskatchewan river 9000 tons more had to be left at the head of navigation until the next open-water season.

ONTARIO

—MINES RUNNING WITH REDUCED FORCES—
ACTIVITY INCREASING AT KIRKLAND LAKE.

Porcupine.—The Dome Mines with a staff of less than 300 men is working at about two-thirds capacity and milling [illegible] tons of ore per day. The installation of [illegible] is now approaching completion and [illegible] is understood to run about $8 per ton. At the Dome Extension [illegible] One of these stopes shows the width of the vein to be [illegible] Development [illegible] is proceeding [illegible] The mill [illegible] is treating about [illegible] ton. The working force of the Hollinger Consolidated has decreased to about 1000 men, resulting in a lessening of the tonnage treated to about 2000 tons daily. In order to meet the difficulty resulting from labor shortage it has been decided to install shoveling machines. The central shaft has been deepened to 1150 ft. and No. 11 shaft, which is being sunk to 2000 ft., taps the old McIntyre veins on the south side of Pearl lake. At the McIntyre men are also leaving, tempted by the high wages to be obtained in the lumber camps and recourse will also be had to mechanical shovelers. R. J. Ennis, general manager, spoke in a highly optimistic vein at the annual meeting on October 24, stating that since the issuance of the annual report the ore-shoot opened up on the 1125-ft. level, 920 ft. long had been proved to be 30 ft. wide, with ore averaging $18 per ton. The total ore-reserves would average $13 per ton, in place of $10 as previously estimated. He expressed the opinion that the main horizon of enrichment had not yet been reached and that commercial ore would be found at much greater depth. Porcupine would before many years be recognized as a deep-mining camp. The main shaft on the Clifton-Porcupine is being sunk from the 100-ft. to the 200-ft. level. High-grade ore has been found on three veins at the 100-ft. level. At the Dome Lake a stope opened up on No. 3 vein between the 500 and 600 ft. levels shows a width of 9 ft. with an average gold content of $12.

Kirkland Lake.—Activity is steadily increasing with the return to the district of many of the former employees who had left on account of the strike. The mill of the Lake Shore is running at capacity on ore from the dumps. As soon as unwatering of the lower workings is completed the main shaft will be sunk from its present depth of 400 ft. to 600 ft. The company has paid a dividend of 2½%. The mill of the Kirkland Lake resumed operations this week, using ore from the dumps. The Crown Reserve has recommenced work on the Canadian-Kirkland property, and the Ontario Kirkland has completed its arrangements for the resumption of activity. Exploration work on the Bidgood property three miles east of the Tough Oakes has opened up several well-mineralized veins.

Cobalt.—The daily production of silver by the Cobalt mines is estimated at upward of $40,000 in value, with every prospect that the output will continue at this rate for some months at least. The court has ratified the agreement under which the Bailey Cobalt will be merged with the Northern Customs Concentrator in a new company to be known as the Bailey Northern Customs, Ltd. The Bailey shareholders will receive one share in the new company for each ten shares of their present stock. As there was a large tonnage of ore blocked out when the mine closed down production will be resumed shortly. The Mining Corporation is preparing to resume operations on the Foster, on which it holds an option. The Kerr Lake during September produced upward of 60,000 oz. of silver. The Hudson Bay mill is treating about 60 tons of ore daily of a grade sufficient to yield a good profit. Patches of high-grade have recently been encountered on the lower levels.

THE MINING SUMMARY

SUSPENSION OF ASSESSMENT WORK

At the present writing, dispatches from Washington indicate that the attitude of Congress toward the five-claim limitation has been changed, and it now seems probable that this limitation may be removed. On November 1, H. J. R. 183 passed the House and was sent to the Senate. If adopted by the Senate, the suspension of assessment work for 1919 will apply to all mining claims, without restrictions as to the number that may be held by any single owner.

ARIZONA

Oatman.—At a meeting of the board of directors of the United Eastern Mining Co. it was decided that after the October distribution dividends will be declared on a quarterly basis. Action with regard to the quarterly distribution on January next will not be taken until the January meeting of the directors. Owing to a strike the property was shut-down for a time in August. Operations were gradually resumed in September, and shortly after October 1 the property was again producing at its normal rate.

CALIFORNIA

Downieville.—Installation of hoisting and pumping equipment is proceeding at the Gibraltar mine, operated under bond and option by Dan McGonigal. Unwatering the 300-ft. shaft is to be pressed and production of gravel from the channel resumed. The lower tunnel is in 500 ft. and is expected to enter the main channel in the spring of the coming year.

Graniteville.—John Phelps has purchased from Thomas Staples the Lucky Strike and Lucky Strike No. 1 gold-copper claims in the Eureka district, and plans aggressive work. Ore of good grade is reported exposed.——The mill at the Spotswood is running on ore from the newly-discovered vein. The lode was uncovered in the main tunnel.

Grass Valley.—Active pumping operations are in full swing at the Idaho-Maryland. Over 500 ft. of the shaft has been unwatered. So far an air-lift has been installed and that method will be used as long as practicable.

The Sierra Asbestos Co., operating near Washington, is milling 100 tons of rock per day for the fibre content and shipping four grades by railroad. The company plans to double production by next year.

Nevada City.—A. D. Foote, general manager for the North Star Mines Co., and associates have taken under bond from Henry Goering and partners the Round Mountain gravel property, three miles north-west of Nevada City. A compressor and power-drills have been installed and driving of the old tunnel resumed with the purpose of intersecting two channels which yielded richly in adjacent territory.

Nevada County.—William Buholtz of Marysville seeks to foreclose a mortgage and have a decree of foreclosure issued against the Black Bear Mining Co. in the Rough and Ready district a few miles west of Nevada City. He holds a claim for $17,529, and with interest the amount totals over $23,000. The mine was a producer years ago but recent operations under company management have not been successful.

Plymouth.—Plymouth Con. Mines has established a station on the 2700-ft. level and started cross-cutting to reach the vein developed on the 2600-ft. level and upper workings. Repairs to shaft are being made and reinforced concrete supports installed. James F. Parke is manager.

Quincy.—The Foundation Mining Co., of San Francisco, is completing arrangements for mining the bed of the Middle Fork of the Yuba river at Hartman Bar. It is proposed to divert the river around a side hill by means of a dam and flumes, exposing the river-bed for a length of 700 ft. and a width of 55 ft. Comprehensive drillings indicate the channel carries rich auriferous gravel 30 to 40 ft. in depth. Approximately $80,000 is to be expended. Julius Becker, of San Francisco, is one of the principal owners of the company, and will manage the enterprise.

IDAHO

Big Creek.—With the increasing demand and high price for silver the mines and prospects of the Big Creek district of the Coeur d'Alene are attracting unusual attention. Ore is being shipped from the Big Creek Mining Co. and the Big Creek Leasing Co., the latter operating the Yankee Boy group, which has yielded more than $100,000 in silver, lead, and copper. A concentrator capable of handling from 75 to 100 tons of ore daily is under construction for the Big Creek Mining Co. Another promising property in that region is the Sterling Silver Mountain group owned by Spokane and Kellogg men.

Wallace.—Two carloads of concentrates have been shipped from the mill at the Interstate-Callahan company. The product is zinc and goes to the Grasselli Chemical company. These are the first concentrates to be shipped from any of the big mines of the Wallace, Mullan, and Burke districts of the Coeur d'Alene since the mines were closed by the miners' strike. The company now has almost a full force of men in mine and mill. A few men are returning to the district each day.

NEVADA

Goldfield.—Driving has started from the 440-ft. level of the Reorganized Crackerjack to open the main orebody, which continues to show a 10-ft. face of $18 ore, with seams running over $21. Driving from the 330-ft. level to develop the East vein is also in progress.——The Conqueror and Sandstorm-Kendall, adjacent to the Crackerjack, are to be re-opened, according to reports current here.——Goldfield Development has increased the scope of activity on its lease on the north-half of Florence-Goldfield and reports 200,000 tons of excellent ore blocked out. Large-scale development of the adjoining Jumbo mine has been decided on.——Red Hill-Florence Co. is saving ore for shipment from the south drift on the 500-ft. level. Ore samples $17 the full width of the drift, with an 18-in. streak assaying $40. Six cross-cuts and drifts are prospecting territory owned by the company or leased from the Florence-Goldfield.

The Goldfield Consolidated has declared dividend No. 25 at a rate of 5 cents per share, payable on December 31 to stockholders of record November 30.

Reservation.—The Nevada Silver Mining & Development Co. has purchased the Dog group of claims in the Reservation district, 3000 ft. south of the V-7 group. The property

is traversed north and south by the V-7 silver-lead vein and east-west by five silver-gold veins. Veins assay $7 to $[illegible] at or near the surface. Arrangements are being made to install equipment, erect surface buildings, and drive a main working tunnel. W. G. Donald, manager for the Motor Finance Co., of Oakland, California, is president, and W. E. Casson, Carson City, Nevada, secretary. Chicago people are interested.——Elkton Divide Co. has been financed by New York people and is preparing to operate a lease on a rich part of the Reservation Hill group.

Oakland people have taken the Review group under bond and option. The property adjoins the V-7 on the south and contains the extension of the V-7 vein, the Golden Fleece lode, and a cross vein, the last assaying $54 in silver at surface.——Comprehensive operations have commenced at the V-7 group under management of George L. Hedges. The property is controlled largely by Californian people and contains several orebodies, of which the V-7 silver-lead vein is the most prominent. A fair tonnage of shipping ore is in sight.

Tonopah.—Forty-six properties are operating in the Divide district, according to a statement by J. Grant Crumley, vice-chairman of the Tonopah-Divide Chamber of Mines. Many of the agitators have departed for other fields, and skilled miners are arriving daily. Most of the properties at both Divide and Tonopah are short-handed, but this condition is being steadily improved. The Southern Pacific Co. has discontinued its sleeping-car service between Reno and Mina, giving as a reason unsettled labor conditions in southern Nevada.

WASHINGTON

Spokane.—Spokane will ask for, and stands a good chance of winning, the 1920 session of the American Mining Congress. Delegates are named by the Northwest Mining Association to attend the 1919 session of the congress at St. Louis, November 17 to 22, and others will be named later by the association and by the Spokane Chamber of Commerce to make a fight for the convention next year.

BRITISH COLUMBIA

Salmon River.—Control of the Premier mine has been sold to the American Smelting & Refining Co. The announcement was made in New York that the consideration was $5,000,000 or more. With the sale goes the management of the mine, which will be conducted from 120 Broadway, New York. R. K. Neill of Spokane and associates remain on the board of directors and retain some interest.

Trail.—The Consolidated Mining & Smelting Co. received 4157 tons of ore in the seven days ended on October 24, as compared with 4148 in the previous week. The receipts in detail follow:

Mine	Gross tons
[illegible]	42
Black Bear, Rossland	591
Centre Star, Rossland	1652
Canada Copper, Greenwood	12
Iron Mask, Kamloops	55
[illegible]	174
[illegible]	258
[illegible]	30
Mowitch, Alamo	21
[illegible]	394
[illegible]	246
Ocean, Sandon	3
[illegible]	31
Quilp, Republic, Washington	479
St. Eugene (zinc), Moyie	39
Standard, Silverton	68
Union, Lynch Creek	32
[illegible]	30

Personal

The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers

D'Arcy Weatherbe is at Vladivostok.

Percy R. Middleton is at Los Angeles.

L. K. Armstrong, of Spokane, is in Montana.

Charles A. Mitke, of Bisbee, is at Pachuca, Mexico.

Frank C. Loring, of Toronto, has been in London recently.

Harvey S. Mudd has returned to Los Angeles from London.

W. R. Degenhardt has returned to San Francisco from London.

F. M. Field has returned from Virginia City, Montana, to Los Angeles.

J. W. Jury has returned from Tavoy, in Burma, to Redding, California.

John Bland, formerly at Denver, is with Charles Butters & Co., at Oakland.

Charles H. White is in Arizona, and will not return to San Francisco until December.

H. R. Plate has gone to New York, and will return to San Francisco about November 25.

J. F. Mitchell-Roberts has returned from Korea and is now making a short visit to Los Angeles.

R. G. Hall, manager for the Burma Mines, has been in London, and is now returning to Burma.

W. E. Simpson has returned to North Hatley, in Quebec, Canada, after spending three months in Europe.

James A. Force, Major in the Field Artillery, has returned to Berkeley from France, after three years service.

Donald H. Fairchild has returned to Denver after examining properties in the Kingman district of Arizona.

J. Parke Channing passed through San Francisco last week on his way to Los Angeles, returning thence to New York.

John H. Farrell was in San Francisco last week on his way from Los Angeles to the Silver Mountain district in Alpine county, Colorado.

Welton J. Crook is returning to California, after having completed the erection of the Emerald mill for the Iron Mountain, Limited.

E. P. Mathewson has resigned from the directorate of the A. S. & R. Co., and has opened an office as consulting metallurgist at 42 Broadway, New York.

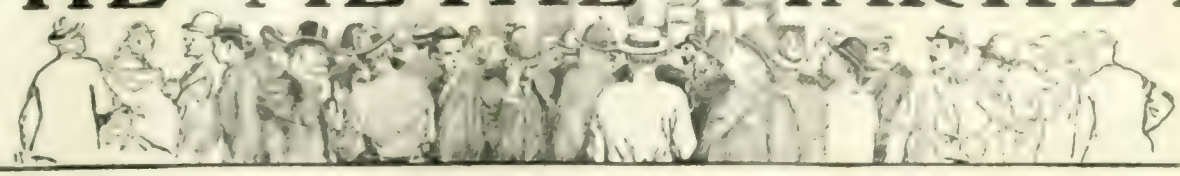
Henry C. Carlisle, general superintendent for the Nevada Wonder Mining Co., Wonder, Nevada, was in San Francisco last week, and has gone to Redding.

Sydney H. Ball has been made a Chevalier of the Belgian Order of the Lion, in recognition of his work in developing the mining industry of the Belgian Congo.

Louis S. Cates, general manager for the Ray Con. Copper Co. and assistant general manager for the Utah Copper Co., left Salt Lake City on October 30 for a two weeks inspection trip of the Ray properties in Arizona.

Kenneth Austin Mickle died at Melbourne, Australia, on July 31. He served in the British army in France and received the D. S. O. In the early days of flotation he won distinction for his research into the physics of the process.

THE METAL MARKET



METAL PRICES

San Francisco, November 4

Aluminum, [illegible] cents per pound	[illegible]
Antimony, cents per pound	10 00
Copper, electrolytic, cents per pound	21 00 — [illegible]
Lead, pig, cents per pound	7 00 — 8 00
Platinum, pure, per ounce	$114
Platinum, [illegible] per ounce	$120
Quicksilver, per flask of 75 lb.	$80
Silver, cents per pound	9 00
Zinc dust, cents per pound	11 00 — 13 50

EASTERN METAL MARKET

(By wire from New York)

November 4—Copper is [illegible] [illegible] is quiet and steady. Zinc is [illegible] [illegible]

SILVER

Below are given official or ticker quotations, in cents per ounce of silver 999 fine. From April 23, 1918, the United States government paid $1 per ounce for all silver purchased by it, fixing a maximum of $1.01⅛ on August 15, 1918, and will continue to pay $1 until the quantity specified under the Act is purchased, probably extending over several years. On May 5, 1919, all restrictions on the metal were removed, resulting in fluctuations. During the restricted period, the British government fixed the maximum price five times, the last being on March 25, 1919, on account of the low rate of sterling exchange, but removed all restrictions on May 10. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the normal rate of exchange.

Date	New York cents	London pence
Oct. 29	121 50	66 50
30	123.25	66 50
31	123 37	65 50
Nov. 1	121 37	65 50
2 Sunday		
3	121 37	65 00
4	122 37	67 00

Average week ending	Cents	Pence
Sept. 23	114 10	62 04
30	117.70	63 14
Oct. 7	119.56	63 71
" 14	117 44	62 83
" 21	117 95	63 98
" 28	119 37	64 45
Nov. 4	122 20	66 16

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan	75 14	88 72	101 12	July	78 92	99 62	106 36
Feb	77 54	85 79	101.12	Aug.	85 10	100 31	111.35
Mch.	74 13	88 11	101 12	Sept.	100 73	101 12	113 92
Apr.	72 51	95 35	101 12	Oct.	87 48	101 12	119.10
May	74 61	99 50	107 23	Nov.	85 97	101 12	....
June	76 44	99 50	110 50	Dec.	85.97	101 12	....

COPPER

Prices of electrolytic in New York, in cents per pound.

Date	
Oct. 29	21 75
30	21 50
31	21 75
Nov. 1	21 25
2 Sunday	
3	21 25
4	21 00

Average week ending	
Sept. 23	22 10
30	21.58
Oct. 7	21.35
" 14	21.72
" 21	21.87
" 28	21.75
Nov. 4	21.37

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan	29 53	23 50	20 43	July	29 67	26 00	20 82
Feb	34 57	23 50	17 34	Aug.	27 42	26 00	22 51
Mch.	36 00	23 50	15 05	Sept.	25 11	26 00	22 10
Apr.	33 16	23 50	15 23	Oct.	23 50	26 00	21 66
May	31 69	23 50	15 91	Nov.	23 50	26 00	....
June	32 57	23 50	17 53	Dec.	23 50	26 00	....

LEAD

Lead is quoted in cents per pound, New York delivery.

Date	
Oct. 29	6 75
30	6 75
31	6 75
Nov. 1	6 75
2 Sunday	
3	6 75
4	6 75

Average week ending	
Sept. 23	6 20
30	6 07
Oct. 7	6 16
" 14	6 25
" 21	6 43
" 28	6 66
Nov. 4	6 75

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan	7 64	6 85	5 60	July	10 93	8 03	5 53
Feb	9 10	7.07	5 13	Aug.	10 75	8 05	5 78
Mch.	10.07	7 26	5.24	Sept.	9 07	8 05	6 02
Apr.	9 38	6 99	5.05	Oct.	6 97	8 05	6 40
May	10 29	6.88	5 04	Nov.	6.38	8 05	....
June	11.74	7.59	5 32	Dec.	6 49	6.90	....

TIN

Prices in New York, in cents per pound:

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan	44.10	85 13	71.50	July	62 60	93 00	70.11
Feb.	51.47	85 00	72 44	Aug.	62 53	91 33	62.20
Mch.	54.27	85 00	72.50	Sept.	61.54	80 40	55.79
Apr.	55 63	88.53	72 50	Oct.	62.24	78 82	54.82
May	63.21	100.01	72.50	Nov.	74.18	73.67	....
June	61.93	91.00	71 83	Dec.	85 00	71.52	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound.

Date	
Oct. 29	8 10
30	8 00
31	7 90
Nov. 1	8 0
2 Sunday	
3	7 85
4	7 90

Average week ending	
Sept. 13	7 90
20	8
27	8
Oct. 4	8
11	7 7
21	7.80
28	8 10
Nov. 4	7 90

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan	9.75	7.78	7 44	July	8 98	8 72	7 78
Feb.	10 45	7.97	6 71	Aug.	8.58	8 78	7 81
Mch.	10.78	7 67	6 53	Sept.	8.33	9 58	7 57
Apr.	10 20	7 04	6 49	Oct.	8.32	9 11	7 82
May	9 41	7 92	6 43	Nov.	7.76	8.75	....
June	9 63	7.92	6 91	Dec.	7.84	8 49	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. Prices, in dollars per flask of 75 pounds:

Date	
Oct. 7	95 00
14	85 00
21	80 00
28	85 00
Nov. 4	80 00

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	81 00	128 06	103 75	July	102.00	120 00	100 00
Feb.	126.25	118 00	90.00	Aug.	115.00	120 00	103 00
Mch.	113.75	112.00	72 80	Sept.	112.00	120 00	102 60
Apr.	114.50	115.00	73.12	Oct.	102.00	120 00	86 00
May	104.00	110 00	84 80	Nov.	102.50	120 00	....
June	85 50	112 00	94 40	Dec.	117.42	115 00	....

MONEY AND EXCHANGE

Foreign exchange continues weak, [illegible] especially reflecting the present disordered conditions in Italy. Discussion of methods of rectifying the exchange situation forms the principal topic for discussion at Atlantic City where at the International Trade Conference American and foreign bankers are attempting to come to some understanding. Speaking before this conference Dwight W. Morrow of J. P. Morgan & Co. said in part:

"The great growth of our foreign trade has forced to the front a problem which vitally affects all the people of this country—the problem of international credits. Merchandise exports for the past five fiscal years ended June 30 were $26,647,091,227. The excess of exports was $13,903,975,807. These figures represent the balance of merchandise exports only. When all the items—visible and invisible—are taken into account the balance must be paid in gold, or its payment postponed by extension of credit. The simplest way for such credit would be for the individual seller in this country to give credit to the individual buyer abroad. The boot and shoe manufacturer of Massachusetts might take the promise of his customer to pay at some future date. Such a theory is unworkable in practice to any large extent. The boot and shoe manufacturer has available for investment only his profits or savings. After he has invested his own savings in a foreign credit he must look about for some other person who has savings and get that person to buy his foreign customers' promises to pay. The manufacturer cannot stop manufacturing to look for the man with savings. He needs the co-operation of a banker, perhaps a thousand bankers whose names he does not even know. The international banker gathers up a thousand little rivulets of capital into one large stream.

"Excess of merchandise exports from July 1, 1914, to July 31, 1919, was approximately $14,200,000,000. There were net exports of $380,000,000 of silver. This made the enormous total of $14,580,000,000. How was that balance settled? Approximately $940,000,000 was paid by net imports of gold. Approximately $12,190,000,000 was covered by credits. Of these, $9,615,000,000 was loaned by the United States government to foreign governments and $2,575,000,000 by people of the United States to foreign governments or enterprises. This leaves $1,450,000,000 apparently settled by invisible items. No one believes we can continue piling up a balance of $4,000,000,000 a year. Yet, with the War over, the excess of exports for the first seven months of the current calendar year was $2,673,000,000, compared with $1,693,000,000 for the same period in 1918.

"I hesitate to guess the foreign credits that will be required in coming months. Imports from Europe are increasing, rising from $21,800,000 in January to $58,600,000 in July. In no one month, however, have our exports to Europe been less than $370,000,000 and in no month to July has excess of exports been less than $340,000,000. If we assume Europe can reduce her purchases from the United States progressively by $10,000,000 each month and increase her sales to us progressively $10,000,000 each month, she will still owe the United States on merchandise balance approximately $2,750,000,000 by next summer. If we assume that the net invisible items in favor of Europe will amount to $750,000,000 by next summer, this would leave $2,000,000,000 to be settled by imports of gold or extension of credits."

Quotations on November 4 are as follows:

Sterling	Cable	4 17
	Demand	4 16
Francs	Cable	8 84
	Demand	8 85
Lire	Demand	10 68
Marks		3 35

Eastern Metal Market

New York, October 29.

All the markets are inactive, due to the generally unsatisfactory labor conditions and the prospects of a coal strike.

Buying of copper has been only moderate and at a great variety of prices, depending on the seller and the quantity, delivery, etc.

The longshoremen's strike at New York dominates the tin market, where nearly all the buying has been for spot delivery at distinct premiums over other positions.

The lead market is very strong and prices have again advanced with some prospects of higher prices later.

Demand for zinc is light but the prices are stationary and the market may be characterized as firm.

Antimony is slightly higher and stronger in a quiet market.

IRON AND STEEL

The prospect of a coal strike has sharply accentuated market conditions produced by the steel strike. There has been heavy buying of pig-iron on advances reaching $2 per ton, and in some cases more. Coke has advanced $1 to $1.50 per ton in a scramble of buyers and active demand has appeared for finished steel products, rendering more general the present scarcity already caused by the steel strike. As to the strike, Pittsburgh mills are working with practically the same forces as a week ago but gains have been made at Youngstown, Cleveland, and Chicago. A growing scarcity of cars in all districts is due to the order restricting the use of the gondola types to coal traffic and ore movements are suffering. More consumers of finished steel have come into the market for fear their operations may suffer for lack of material. Where steel billets either for forging or rolling can be had on new orders the price is $5 per ton above the so-called schedule, $43.50 at mill having been done in the East for re-rolling billets. Plates and bars still lead in the current buying. Mills able to make deliveries are holding to 2.50c., Pittsburgh, for steel bars and Eastern makers have advanced bar iron $5 per ton to 2.75c., Pittsburgh, for common iron. Plates are firm at 2.65c., Pittsburgh, for this year and one Eastern company has quoted 2.75c. for delivery in 1920. Japanese buying is still heavy, their shipyards being sold months ahead. The 50% advance in British railroad freight-rates has put pig-iron up 5s.3d., or $1.10 per ton. American tin plates at $7.80, New York, have been sold to Japan and South America on competition with the Welsh product, which is now $8.60 at works.

COPPER

The situation continues extremely mixed and confusing. Demand is not heavy but the sales that are being made are evidently at widely varying figures, depending on the sellers. It is understood that electrolytic copper for November delivery is sold anywhere from 21.50 to 22.50c., New York, but it is believed that the average of the market is still 21.75c., New York, which we quote as the market price. For Lake copper the quotation seems to be around 22.50c., New York. The longshoremen's strike in New York has considerably interfered with export business, however small or large that might be, and also domestic buying has suffered. It is estimated by some that production now is in

TIN

The market has been quiet but the situation is dominated by the longshoremen's strike, which is now in its third week. There has been a better inquiry for spot shipment without regard to strike conditions, and this has of course commanded a premium. Prices for this, however, have been irregular because sellers' views varied widely so that there was a spread of ½ to ¾c. in prompt tin. Sales have been made in the week, however, from 56 to 56.75c., New York, the latter being the quotation today for spot tin, New York. Tin, ex-steamer at dock, has sold down to 54c., New York, but it is of course not available. Strike conditions are somewhat better and it is said that the steamers 'Homestead' and 'Gaelic Prince' are being worked now, both having heavy tin consignments aboard. The harbor is reported choked with vessels and it is stated that some British ships will return to England without unloading. This is especially true of mail vessels. Very little has been done in far future shipment; the quotation for November shipment from the Straits is 52.50 and 52.75c. asked, the lower prices being due to a slump in London. Tin arrivals to date have been 8100 tons, of which only 150 tons has come in at Pacific ports. The quantity afloat is 2795 tons.

LEAD

The market is very strong and quite active. On October 23 the American Smelting & Refining Co. again advanced its price ½c. per lb. to 6.75c., New York, and 6.50c., St. Louis. Independent producers followed wherever they could, that is, those that had any metal to sell. Some strikes have been settled and production is better. There seems to be but little lead in second hands, most of it having been cleaned up. There are sellers at close to the Trust price and lead in transit has been offered at 6.80c., New York. A large producer-seller states that he has sold lead this week at 6.85 to 6.90c., New York, and is now asking 6.95c. He also predicts another advance in the price of the leading interest within 10 days.

ZINC

There has been little change in the market and very little business the past week. Prices have remained steady. Prime Western for November delivery is quoted at 7.75c., St. Louis, or 8.10c., New York. The strike situation is the dominating factor and has held back buying both for domestic and export consumption. The general undertone is strong, however, and better times are looked for in the near future. Operator-producers have been the main buyers recently.

ANTIMONY

The market is stronger at 8.75c., New York, duty paid, for wholesale lots for early delivery, due to more active buying for spot delivery.

ALUMINUM

Wholesale lots of No. 1 virgin metal, 98 to 99% pure, are unchanged at 32 to 33c., New York, for early delivery. Remelt metal of the same analysis is 1c. under these levels.

ORES

Tungsten: It is stated that any consideration by the Senate of the tariff bill on tungsten or any other tariff matter will not be scheduled until the Peace Treaty is disposed of. In the meantime the market is dull and stagnant with quotations nominal at a range of $6.50 to $12 per unit, depending on the kind of ore, quantity, and delivery. As to ferro-tungsten, quotations seem to be unobtainable. Some say values are around $1 to $1.50 per lb. of contained tungsten. The British price is 2s.10½d. per lb. for low carbon, 75 to 80% alloy. It is a fact that importations of the British product are on the way to this country or have already arrived.

Molybdenum: Quotations continue nominal at 75c. per lb. of MoS_2 in 90% concentrate in an inactive market.

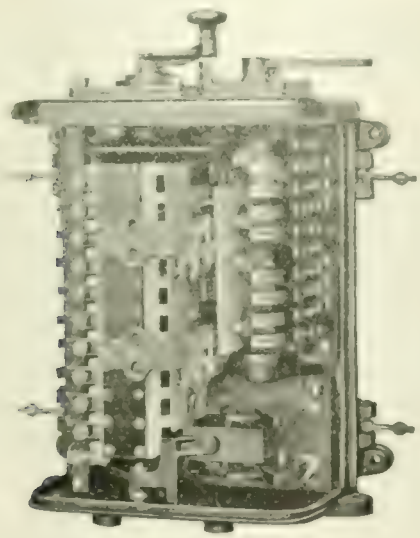
INDUSTRIAL PROGRESS

INFORMATION FURNISHED BY MANUFACTURERS

DRUM CONTROLLER FOR SERIES-PARALLEL OPERATION OF LOCOMOTIVE MOTORS

A [illegible] type controller for series-parallel control of two motors is one of the new products of The Cutler-Hammer Mfg. Co., Milwaukee, Wisconsin. This controller, which is provided with both a main cylinder and a reverse cylinder, is for use on storage-battery locomotives or on trolley locomotives using 250 volts or less.

The motors are accelerated by the main cylinder, which has seven points of control. A star-wheel provides an interrupted motion to the lever, so the operator readily feels the speed points. The fourth point is the full series or low



New C-H Drum Controller

speed running point and the seventh and full parallel or high speed running point. All intermediate points are resistance points. The Wheatstone bridge method is used for transition from motors in series to motors in paralled between the fourth and fifth points of control, and as the circuit is not opened, continuous torque is obtained during the transition. Arc barriers are provided between each contact finger, and strong magnetic blow-outs prevent excessive arcing.

The reverse cylinder is positively interlocked with the main cylinder so it cannot be operated when the latter is in any but the 'off' position. The fingers of the reverse cylinder are therefore not used for making or breaking the current; hence the contact parts will last indefinitely, and magnetic blow-outs are unnecessary.

Two cut-out switches allow either motor to be by-passed, if it becomes damaged in any way, and the locomotive can then be operated by the other motor until repairs are made. When one cut-out switch is thrown to by-pass its corresponding motor, mechanical interlocks prevent closing the other cut-out switch or operating the main cylinder beyond its full series position, thus eliminating the possibility of a short circuit.

A dust-tight and weatherproof construction is obtained by fitting the sheet metal cover under a ledge in the top and providing a rubber gasket between the edges of the cover and the cast-iron frame.

This new controller has the following features of construction common to other C-H drum controllers: cast-iron sections of cylinder clamped on square insulated shaft, using no keys or taper pins, thus making removal easy; cylinders readily removed from case by merely taking off top plates; steel contact fingers of main cylinder mounted on square insulated metal shaft, which can be removed by taking out two cap screws; all fingers provided with drop forged copper tips of the non-stubbing type.

The contact fingers and segments may be adjusted or renewed without removing the cylinders from the drum case. Those on the reverse cylinder are exposed by merely loosening two thumb-nuts and throwing back the blow-out plate and arc barriers.

Most mine-duty apparatus is employed where the service conditions are severe and delays in operation costly; consequently this new controller has its parts liberally proportioned to prevent wear and breakage, and those parts which do wear are made accessible and easily renewable.

SYSTEMATIZE MOTOR-TRUCK LINES

By E. A. Williams, Jr.*

Systematic organization of motor-truck express lines already in operation, together with intelligent addition of new routes, will afford at least a part solution to the present high cost of living problem, according to men prominent in industry and commerce. Lack of adequate transportation is one of the chief reasons offered for the present crisis. In many cities, Government and State officials are investigating food waste which, according to the commission men, may be traced directly to transportation delays. There are numerous instances of commission firms having been indicted for the wholesale disposal of foodstuffs which, the commission-men claim, were delivered by railroads in unsalable condition. Efficient organization of the motor-truck lines in various communities with the idea of eliminating the possibility of idle trucks and light return loads will go far toward solving this transportation problem and reducing transportation costs, in the opinion of many who have given this phase of the matter careful consideration.

To obtain maximum returns from motor-truck transportation, lines now operating should be systematically organized. Without unity of purpose there is a capacity waste in every community. This naturally results in a loss of tonnage and increased costs. It has been said that 70% of the motor-trucks operating in the United States during 1918 traveled empty one way. From these figures it was estimated there was a capacity waste of 283,500,000 tons during the year. With the establishment of highway transportation commissions in the various States and the organization of transportation bureaus in many of our cities this tonnage waste is being eliminated. In several cities the haulage concerns have formed associations and have estab-

*President of the Garford Motor Truck Co.

lished central offices from which the motor-truck transportation activities of that particular community are directed. The [illegible] are affiliating with associations in nearby cities in order to decrease further the possibility of idle trucks and light return loads and to increase the general efficiency of the service. The motor-truck actually has become a public utility in many localities. Entire communities are depending upon it as a means of supply. It has become equally as essential as the railroad and waterway.

To obtain maximum efficiency, the transportation units of the country—the railway, waterway, and highway—should be linked up systematically. More highways should be built, the present highways improved, and a greater number of motor express lines touching those districts not reached by either rail or water, should be created. That such a system would have important bearing upon reducing the cost of living essentials is apparent. Available Government figures show that in 1919 the cost of shipping by truck throughout the country was from 10 to 30 cents per ton-mile lower than the cost by horse-drawn vehicles. One can at least imagine what this will amount to in a year. Speakers before a recent convention of retail and wholesale grocers in Toledo voiced the opinion that their hope of reducing prices lay in the motor-truck. Practically an entire session of the convention was devoted to this phase of the transportation problem, which they deemed highly responsible for the present high costs. One speaker, an officer of the grocers' organization, declared that the motor-truck held the actual solution to the problem. This recognition of the motor-truck as a transportation factor, coming from men who analyze and understand conditions governing the markets, is noteworthy and should be taken as convincing proof of its worth.

SHALL RESTRICTIONS ON TRANSPORTATION BE PERMITTED TO LIMIT DEVELOPMENT?

By R. E. Fulton*

With the constantly increasing volume of transportation upon our highways, not only the development of the future, but also the needs of today, must be kept in mind. Only one thing can be assumed as certain, and that is that the amount of transportation will continue to increase every year. The problem before us is not primarily good roads nor motor-trucks, but how shall we handle the volume of traffic that is increasing every year at such a rate? In meeting this problem, we must keep in mind first of all that transportation must be cared for; we cannot reduce it or abolish it. We must build our roads up to the demands made upon them by the needs of the people. We cannot permit progress to be strangled by inadequate transportation facilities.

From an economic standpoint, this development of highway transportation lies in the use of larger capacity units. If transportation efficiency is to be the standard, our highways must be constructed or rebuilt to carry satisfactorily heavy motor-trucks of even larger capacity than the largest now in use. If the railroads had been forced to adhere to the 40-lb. rail, instead of advancing steadily to the 70-lb., the 80-lb., and 90-lb. rails, which make possible the powerful locomotives and heavy trains now in use, it is not difficult to picture the economic handicap to railroad transportation, and with it the curtailment of the development of this country that would have resulted. The only difference between highways and railroads is that the highways are publicly owned, whereas the railroads are privately owned.

In the matter of initial cost of motor-trucks, there is a marked gain in economy with the larger capacities. The cost per ton capacity in the case of the average half-ton truck is $2028, for the 3-ton capacity vehicle, $1322, and for the 7-ton, $740. There is no doubt that the ratio of increased economy will hold for sizes up to at least ten and twelve-ton capacity trucks. In the operation of trucks we find increased economy on the per ton load capacity basis, not in a few or even a group of items, but in practically every charge coming under the head of operating cost, from fuel to depreciation, and from driver's wages to insurance. Where large units can be used they materially decrease the ton-mile cost of transportation. Comparing the 2-ton capacity truck with the 5-ton capacity, we find that in increasing the load carried 150%, the operating cost is decreased 18.2%; while comparing the 3-ton with the 7½-ton, there is also a 150% increase in carrying capacity with a decrease of 22.8% in operating costs. Unquestionably, this ratio will hold good for much larger sizes, so maximum transportation efficiency in motor transportation must be sought in vehicles with carrying capacity greatly beyond the largest in use to-day. In view of these facts, our highways should be built to stand the amount of traffic that is demanded of them. Limiting the gross weight of any vehicle to less than 28,000 lb. is short-sighted economy for the present that is storing up a large amount of trouble and expense for the future. Roads must be built to meet the requirements, for the requirements cannot be limited to road conditions.

*Vice-president, International Motor Co.

COMMERCIAL PARAGRAPHS

C. W. Cross has been appointed by the **Chicago Pneumatic Tool Co.** as manager of western railroad sales, with headquarters at Fisher Bdg., Chicago.

The **A. H. Simpson Co.**, San Francisco, has purchased the mill of the California Quicksilver mine situated about 42 miles from Winters, California. This 100-ton mill had been in operation only about 60 days. The equipment consists of a ball-mill, gas-engines, compressor, concentrators, drill steel, rails, etc. Orders are solicited for any part of this material. Shipment can be made promptly.

The industrial growth of Texas and Oklahoma, the increasing importance of their oil industries, and the large demand made for modern machinery in this and other lines, has led the **Ingersoll-Rand Co.** to establish a branch office to serve this territory. The new office, in the Sam Houston Life Bdg., Dallas, Texas, will be in charge of R. H. Brown, Jr., as manager. Mr. Brown has heretofore been connected with the company's St. Louis office and has, for years, been in intimate touch with the Texas-Oklahoma territory.

The complete 500-ton concentrator and 250-ton copper smelter of the Penn-Wyoming Co. at Encampment, Wyoming, is being dismantled by the **Morse Bros. Machinery & Supply Co.** of Denver. The 16½-mile Leschen tramway is also being prepared for shipment. This tramway was built in four sections of four miles each, and is available for immediate use. Over 96 miles of wire rope, 925 buckets, 196 towers, and tension stations, with complete terminal irons make up the tramway equipment. This was said to be the longest successful tramway in the world.

The dust nuisance is a problem that confronts most manufacturers that have to grind or handle fine, dusty material. On account of the many difficulties caused by a dust-laden atmosphere, most modern plants are making efforts to solve the problem. The solution in general takes the form of some device for filtering the air and collecting the dust in the filter. To meet the increasing demand for apparatus of this sort, the **Allis-Chalmers** company has developed and is now placing on the market a patented bag-filter type of dust-collector. This is the first machine of this type to be designed, built, and put into successful operation by an American manufacturer. It is completely described in Bulletin No. 1454.

GOLD from the South African mines is being sold at a premium of 15%. This was stated by Sir Evelyn Wallers at a recent meeting of the Transvaal Chamber of Mines. He added, however, that there was no knowing how long such a premium would be obtainable.

EIGHTY periodicals are said to have moved from New York on account of the strike of the printers' men and the walk-out of the compositors in that city. They have moved to different cities. The 'Engineering and Mining Journal' has produced its issue of October 4, from plates, in San Francisco, and we are glad to see it. We hope that its troubles, entirely unmerited, will soon be over.

LIFE and work in the Orient is the subject of an interesting article in this issue by Mr. Gilmour E. Brown, who will be recalled as the author of an informing account of 'Mining Development in China', appearing in our issue of May 17 last. Mr. Brown has had a wide and varied experience in China, the Malay States, and the Dutch East Indies; he gives the younger men in the profession many useful hints concerning the conditions under which mining engineering, more particularly the examination of prospects, has to be done in that part of the world.

IN the 'Personal' column will be found mention of Mr. Frank M. Smith's appointment as representative of the Bunker Hill & Sullivan Mining & Concentrating Company at Spokane. Mr. Smith has been in charge of the East Helena smelter, of the American Smelting & Refining Company, for 17 years. Mr. Jules Labarthe is director of the Bunker Hill smelter, Mr. Stanly A. Easton is resident manager for the company, and Mr. F. W. Bradley, of San Francisco, is president. We understand that the company intends to expand its smelting business by bidding for a larger tonnage of custom ores, and has engaged Mr. Smith, a Western man of wide experience and proved sagacity, for this purpose. The smelter was designed by Mr. Labarthe, of the firm of Bradley, Bruff & Labarthe, and is one of the best equipped plants in the United States.

CONGRESS is said to be considering the planning of a national budget. It might begin by stopping some of the waste exhibited by the 'Congressional Record'. A recent issue, that of October 8, consisted of 64 pages, including the reprints of sundry articles from daily papers, a sermon attacking the President, and an article by Mr. Frank Simonds on the failure of the Peace Conference, besides the report of a debate between a member of the Federal Trade Commission and a representative of the Chicago packers. We may add that we find it unnecessary to buy any scribbling paper for our own use. It is supplied by various departments of the Government, their circulars fortunately being printed on one side only, and we confess that in many cases the blank side interests us more. The extravagance at Washington sets a bad example to the people of the United States.

AS many of our readers are aware, the California Metal Producers Association and the State Chapter of the American Mining Congress have co-operated since January last, when the second organization was started. On October 22 the two organizations were merged by the absorption of the Metal Producers Association into a local section of the Mining Congress, to be known as the California Metal and Mineral Producers Association. Mr. George W. Starr has been elected president, with Mr. E. C. Hutchinson as first vice-president. Mr. Robert I. Kerr, the efficient secretary of the former Metal Producers Association, will serve as secretary-treasurer of the consolidated organization, which will include those interested in oil exploitation as well as in metal mining. We bespeak the support of the mining men of the State for this organization, which is in excellent hands and is thoroughly capable of representing them in matters of legislation or any other question affecting the industry.

MINING in the North-West is sure to receive a stimulus from the purchase of the Premier, or Bush, mine in British Columbia by the American Smelting & Refining Company. The price, for a 51% control, has been stated variously as one million and five million dollars; we understand now that it was $4,000,000. The Salmon River district, in which this rich silver mine is situated, is at the head of the Portland Canal inlet, which is one of the many natural cross-cuts made by the sea, in the wake of erosion, through the Coast range. This region has been made noteworthy by the Hidden Creek mine of the Granby Consolidated company, which has established a large milling and smelting plant at Anyox, on Observatory inlet, and also by the Dolly Varden, another important mine a little farther inland. The three mines mentioned are all a short distance inside the boundary of British Columbia; they just fail to be in Alaskan territory. The account given, in our issue of last week, by Mr. Charles Bunting of the manner in which Mr. R. K.

Neill, of Spokane, discovered the orebody in the Premier mine, is well worthy of careful reading. Mr. W. J. Rolfe did the first exploratory work five years ago and found enough rich ore to attract the attention of capitalists. These were represented by a well-known mining engineer, Mr. H. R. Plate, who started exploratory work in the winter of 1915 and continued the search for ore until early in 1918. Mr. Plate failed to find any large orebody, but Mr. Neill was not discouraged by this failure; on the contrary, he thought well enough of the prospect to bond it for $100,000 and to begin work on his own account. Then ensued the tragedy of mining, from the point of view of his predecessor, namely, the demonstration of the fact that the No. 1 tunnel had been run parallel with a rich vein for a length of 250 feet, missing the ore entirely. Cuts of only six feet sufficed to disclose a bonanza of more than ordinary dimensions. From Mr. Bunting's description it would appear that the tunnel was driven diagonally across the ore-shoot where it was poor and then became diverted by a slip that took it away from the vein, continuing at a small distance from it until the vein was cut in the breast just before work ceased; but unfortunately at this point the vein was almost barren and so poorly defined that Mr. Plate failed to realize that he was on the right trail at the moment of abandonment. As Mr. Bunting says, "this is an outstanding example of a great mine being missed by a very small margin". It is by no means the first example of such a mishap. We venture to say that such misses are due to the failure to follow the traces of ore and the hankering to drive ahead in easy ground. A lode is something that 'leads' a miner; he must take care not to be misled by other structural conditions, keeping his eye on any traces of ore that may persist after his lode has become pinched or poor. There is no worse method of exploration than that of running workings in straight lines or on a plan of operations devised at the surface for convenience in tramming. The first step in mining is to find ore and the second is to follow it, disregarding the allurements to extend a drift or a cross-cut to one side. To prevent a false step, it is necessary to give close attention to the evidence accruing from day to day. Here is where the man accustomed to prospecting, to 'nursing a prospect', as we say sometimes, shows his ability, as Mr. Neill did. His is the reward that comes to a true miner.

IN our issue of October 11, referring to mining in Korea, we wrote of "the late" Hansaburo Hunter. We learn now that this statement is "greatly exaggerated", for Mr. Hunter is very much alive. We confused him with his father. Apropos of Korean mining, we have received the latest annual report of the Seoul Mining Company, which is operating on the Suan Concession and is the scene of the operations being described in the series of articles by Messrs. Weigall and Mitchell-Roberts. In the year 1918 the Seoul company produced $734,405 in gold, $31,960 in silver, $580,066 in copper, $10,708 in bismuth, and $664 in tungsten, besides making $46,882 by interest and exchange, this last being characteristic of operations in the Orient. The gross profit was $267,527, of which $94,514 was set aside for depreciation, as against a net profit of $330,526 in 1917. The total production of metals was worth $1,343,234, from 201,151 tons of ore, averaging $9.64 per ton. The operating cost was $4 per ton.

Mining Speculation—I

We note that the 'Financial Times', the leading daily financial paper of London, has been publishing a series of articles on 'Mines and the Speculative Investor', written by its mining editor, Mr. J. A. L. Gallard, who has recently returned to his desk from military service in France. These articles are interesting because they have been prepared by a journalist keenly in sympathy with the best traditions of the mining business in a city that was the centre of mining in its worldwide aspect, and they are also interesting because it is not often that a financial paper discusses the technical phases of mining in a manner at all convincing to those well versed in it. The first article begins by noting the fact that during recent years a large number of new speculators have come into the mining market on account of the heavy taxation of incomes, the incidence of this taxation having driven them to purchase shares for capital appreciation, which, it appears, is not taxable in England, rather than for dividends, which are at the mercy of the tax-collector at their source. Among those who are participating in mining-share speculation are many unversed in the technique of mining operations or even in the terms used in the reports sent by the managers of the mines themselves. Hence Mr. Gallard's articles, which are meant to help the novice. He avoids the nice question whether mining is an 'investment' or a 'speculation' by calling it a 'speculative investment'; at least he writes his articles for the "speculative investor", which is not a bad name for those who, when they buy mining shares, are uncertain whether to treat them as a speculation or an investment, leaving it for the logic of events to decide whether to sell soon, after a big rise or a heavy drop, thereby making it a speculation, or to hold their shares a long time, for the sake of the dividends, thereby making them an investment. Of course, if the purchase is made in the hope of a rapid appreciation of the capital, or principal, it becomes a speculation. Mr. Gallard says that he has heard mining engineers deplore the fact that the mining industry should be so closely associated with speculative activity. The wish has been expressed that the mining industry should be "entirely dissociated from the Stock Exchange". He replies to such idealisms promptly and confidently by asking how could the money for the exploitation of mineral deposits be obtained except by affording facilities for dealing in shares? To this we would add that if the finding of capital for mining were confined to those able to hold mines and work them to the point of exhaustion, the number of mines active at any time would be small. By sub-dividing the ownership by means of shares it becomes possible for many to

take a hand and at the same time it enables the originators or promoters of mining ventures to transfer their holdings piecemeal on an open market. In other words, the many, called the 'public', are able to join the few, called the 'insiders', in working mines. Sometimes the insiders find it more profitable to work the public, rather than the mines, but that is another story. Mr. Gallard recognizes the speculative character of mining shares, the uncertainty as to their real value being due to the variable character of ore deposits, the fluctuation in the market-value of the metals they yield, the varying skill of the management, and the vagaries of the share market itself. He considers that this very uncertainty, so characteristic of metal mining, is responsible for the increase of public participation in the speculation incidental thereto, because "the uncertainty affords scope for the imagination and opens up possibilities of handsome profit". That is true. The increase of taxation and the lessening value of money have made the gilt-edged investments, with their 4 or 5% return, unattractive as compared with the 'flutter' in stocks that afford a chance of doubling one's capital within six months or of drawing a 25% dividend for a few years, at least. There is this to be said, that the average man finds it difficult to invest safely; out of five 'dead-sure' investments, one is likely to go wrong; the miscarriage of one out of five of his supposedly safe investments involves a loss nearly equal to the interest obtained on the other four; so he decides that it will be good business to take large risks, with the chance of large gains, on one commitment, at least. He thinks to average by four investments and one speculation. Some such policy or plan of operation is common with the majority of men having money that they wish to put out for an unearned increment. As a detached, but sympathetic, onlooker, we would say that the average man unversed in mining, but desiring to speculate in mining shares, is foolish to risk money that he needs in his business or for his home; if he speculates—and mining to such a man is necessarily a speculation—he should use only money that he can afford to lose, that is, a sum so small relatively that the loss of it will not cripple him financially. Another suggestion we venture to make is that a high rate of interest usually indicates risk. A gilt-edged bond or preferred stock will not pay 7%; if it is safe and pays 7%, it will be quoted at a price yielding 5%. The average man, namely, one not having access to expert financial advice, his own or another's, should distinguish between an investment, which yields a low return and is safe, and a speculation, which yields a large return and is risky. He should make up his mind whether he can take a risk or not. If he cannot afford to run a risk, he should content himself with a low rate of interest, postponing a hazardous venture until he has some money on the side that he can afford to lose. The tragedies of mining are those of poor people venturing their all on a risky undertaking, not the losing of large sums of money by rich people. Mining is not adapted to the productive use of money belonging to widows and orphans; it is a man's game.

State Insurance: An Experiment

Among the institutions devised by civilized man for the purpose of alleviating the consequences of such disasters as are due to natural causes there is none giving better proof of his sagacity than insurance. It means the making of oneself safe against something, more particularly the risks of life. By means of it we carry one another's burdens and break the severity of the blows that fate may have in store for us. The first appearance of insurance is recorded in the marine loans of the ancient Greeks as described by Demosthenes. In medieval times this practice had become well developed in maritime affairs, the mariner making a bet, as it were, that he would not return safely with his cargo, whereas the marine gamblers bet that he would escape the hazards of storm and piracy. If he returned, he paid the short end of the bet; if he failed to reach port, his heirs received the long end of the bet. At Lloyds to this day it is possible to hedge against bad luck by making bets on every conceivable subject, from the weather that may spoil an outdoor performance to the death of the Prime Minister. The odds are given upon an expectancy founded upon the experience of the past, hence they have a logical basis. So has life insurance, which is a highly scientific business built upon actuarial statistics. The same is true of accident insurance and, to a less degree, of fire insurance; both have been elaborated on a scientific rationale. Such a business, of course, lends itself to trickery, for the ensured may not tell the truth and the ensurer may evade his contract. Therefore governments have taken cognizance of it, by passing laws regulating the business; but this has rarely sufficed to protect the public against the predatory phase of insurance, so that forms of mutual insurance have been devised. Likewise employers have ensured their employees and then ensured themselves in turn against the obligation created thereby. In several progressive countries, such as England and New Zealand, the employer has been compelled by law to carry insurance for the protection of his employees, with a choice either of providing means for insurance himself or of contracting with an insurance company to do it for him. The smaller employer could not carry the insurance of his employees without incurring a dangerous risk and the insurance companies demanded excessive rates, so, in New Zealand, for example, a fund was provided by the State for the purpose, and while this did only 10% of the business, it served to regulate rates. New Zealand claims that England copied her methods; indeed, it appears that the land of the Maoris was the first State to underwrite, beginning with life insurance and then extending it to compensation. The Californian law follows the British system, not the German, being founded on the common law of the English-speaking peoples. It was the experience of New Zealand that prompted the members of the Industrial Accident Board, in 1912, to introduce the legislation necessary for this purpose. The Workmen's Compensation, Insurance, and Safety Act was passed in 1913 and went into effect on

January 1, 1914. The Act was designed to provide compensation for wage earners when hurt in the course of their work, to devise ways and means for preventing accidents, and to afford employees an opportunity, at their option, of taking out insurance against the compensation risk under State auspices. This legislation was not accomplished without vigorous fighting, for, as might be expected, the insurance companies claimed that the business belonged to private enterprise, whereas Mr. A. J. Pillsbury and his friends of the Accident Board insisted that insurance was a public service and that the welfare of the community required the institution of compensation insurance, at least. It was contended that politics must get into the management of the State Compensation Insurance fund, the control of which was given by the State to the Industrial Accident Commission. Attempts were made, by insurance carriers, to make this forecast come true, but the two Governors in office since the Fund was created have shown unusual forbearance from the exercise of political interference, and the manager selected to administer the Fund, Mr. C. W. Fellows, has proved himself a man of exceptional ability and integrity. It was predicted that the State would get the bad risks, and the companies the good ones. This was not an unreasonable expectation, but it has been falsified by events. Pains have been taken to aid the bad risks to become good risks before they were given insurance; and this has been done with gratifying success. The ratio of loss to the Fund is lower than that of other insurance carriers; the selection of risks by the State has been done with as good a judgment as that of the insurance companies and with much better discernment than that of a number of companies whose underwriting has driven them off the field of competition. It was asserted that private enterprise can do business cheaper than the State. It can, but it does not. The overhead expense of the companies last year was 40%, whereas the Fund did business for slightly under 12% of its receipts. Thus the State is transacting its insurance business at less than one-third the cost set aside by the companies for that purpose, and yet the State bears not one dollar of the expense of the Fund. The only advantage that the State fund enjoys is that the State pays the salaries of the Industrial Accident Commissioners, who sit as a board for directing the general policy of the Fund, giving, however, not more than two hours per week to this work. The Fund pays the same taxes, except the Federal, as other insurance carriers; it pays for all its labor, rent, and every other item of cost incurred in doing an insurance business, but it does not wine or dine legislators and it does not bribe employers to give it their business. The State fund is now doing 40% of the ensuring for compensation, as against 60% that goes to stock companies. These attribute their success to salesmanship. The real incubus on the business is the insurance broker, who is only one of the many unnecessary and misplaced middlemen contributing to the excessive cost of living and dying. The insurance broker is paid by the wrong party; in consequence, the insurance company has to fight as tenaciously to hold its old business as to get new business. The State fund escapes this burden and in the end will get all the business unless crippled by adverse legislation. The Fund started with a capital of $100,000 and the Legislature appropriated $68,470 for the use of the Commission in supporting the Fund for two years in the event of its business not proving self-supporting. None of this appropriation has been so used. The record of the last five years is given herewith, showing the premiums received annually and the cost of doing business.

Year	Premium	Cost, %
1914	$547,161	12.65
1915	655,676	15.48
1916	928,286	14.05
1917	1,373,791	14.76
1918	2,459,086	11.79

It will be noted that the average cost in the five years was 13.75%. The original capital of $100,000 has not been touched. For two years now the Fund has paid 4% interest on this sum into the Accident Prevention Fund. The business of the State Compensation Insurance Fund for the five years has resulted in a surplus, exclusive of the $100,000 capital, amounting to $1,038,959. The average profit per annum has been $207,792, and the ratio of profit to capital, which always remained invested at 4½%, has been 207% per annum. Up to last June, a sum of $1,039,533.57 has been received in dividends by the policy-holders, to whom the Fund has paid a dividend averaging 15% regularly at the end of each year and a second dividend averaging about 20% after 3½ years. In this way those who ensure with the Fund get their business at exactly what it costs, no more and no less. A sum of not more than $1,000,000 is needed to protect the Fund against a possible catastrophic hazard and make it strong enough to ensure the largest risks. If no dividends had been paid the policy-holders, the average profit for the five years would have been 338% per annum. This throws an interesting light on the insurance business. Unquestionably the State Compensation Insurance Fund of California has been a great success. This has been due to exceptionally good management, to the enlightened enthusiasm and absolute integrity of the Industrial Accident Commission, and to the consequent exclusion of the graft and chicanery that usually blight the administration of State control over industrial activities. It is worthy of note that many of the largest mining companies in California have availed themselves of the opportunity to take compensation insurance in the State fund. This adventure in State insurance should awaken the interest of every citizen in this and other States, for it represents an experiment that gives promise of bigger things. It suggests other forms of insurance for the relief of human hardships, such as sickness, unemployment, injury, and old age. The systematic mitigation of these common hazards promotes the happiness and self-respect of the members of the community, and the stability of the social organization; and thereby serves to check anti-social vagaries and present a resolute front to the sentimental anarchy of bolshevism.

Smelting Zinky Lead Ores

The Editor:

Sir—In your issue of July 12, Herbert Lang, in his interesting "Metallurgical Journey to Shasta", referring to the ores of the Afterthought mine and to the trial there of smelting in reverberatories using wood as fuel, says: "It should have succeeded . . . the reverberatory furnace is superior to the blast-furnace in treating zinky ores," and further, "although the abundant zinc in the Afterthought ore would have proved a serious obstacle, this method, even now, is far preferable, under the circumstances, to the blast-furnace process that succeeded it". Further on, again, he suggests that the abundant supply of wood should be utilized in reverberatory smelting, although "direct firing with wood may not answer on so large a furnace".

If Mr. Lang were acquainted with Australian practice he would have written more strongly, and his doubts, as to the effect of high zinc and the possibility of heating large reverberatories with wood, would be set at rest. Wood-fired reverberatories have been in use throughout Australia since the early days of smelting, 60 or 70 years ago, and, wherever conditions are favorable, are still in use. It is possible to heat furnaces, up to at least 50 ft. in length, with wood only by hand-firing. At this place we have had a furnace working many years which is 40 ft. long between bridge and vulcatory, and, I am told, the Lloyd's copper mine, at Burraga, in New South Wales, has one that measures 50 ft. between the same limits. Both use nothing but wood, with no special means to aid the combustion of the fuel.

At this mine we found that it was an advantage to provide the fire-box with two doors, and the air-holes over the bridge drew their supply from the culvert beneath the hearth, which consists of four arches instead of the old-fashioned single arch. We provided a side tap-hole for slag, as well as the usual end-skimming door; we have no difficulty in keeping the charge liquid; the greater part of the slag is run off, without skimming, from both places. It is found, with these big furnaces, that it is an advantage to run a first lot of slag from the side door, about half an hour before the charge is finally 'ready' for the front-door discharge. I shall be pleased to give plans and photographs of our 40-ft. furnace to Mr. Lang, if requested.

Mr. Lang is undoubtedly right when he says reverberatories surpass blast-furnaces in treating zinky ore, but I believe he is wrong in thinking "abundant zinc in the Afterthought ore would have proved a serious obstacle". He quotes that ore as carrying 2.8% copper and 15% zinc. The Silverspur ore averages 1.25% copper and 26% zinc, and thousands of tons have been smelted carrying 30% zinc. Our slag-dump averages 25% ZnO, and under 30% SiO_2. The idea that high-zinc slags are thick and will not run is quite erroneous; a high-zinc slag is very liquid and would run for miles, if required and the supply were kept up.

The whole secret in smelting copper ore high in zinc, to matte, in reverberatories, lies in keeping down the sulphur. Probably the sulphur limit varies with different ores; in our case, so long as the sulphur *in the ore* does not exceed 10%, we have no trouble; 8% is better; but the moment the sulphur rises above 10% trouble begins. With 1.5% copper and 8% sulphur in the ore, no zinc-matte is formed, and the matte, which averages 35% copper, contains seldom more than 2% zinc. The only flux we use is limestone, which forms about 15% of the charge, and occasionally ironstone and quartz. Ironstone we try to avoid, as it increases the silver in the slag. I think there is no doubt a higher temperature is needed to smelt zinky ores than is required for ores free from zinc; but the heat can be obtained from wood fuel with ease.

To my mind the Afterthough ore, with 2.8% copper and only 15% zinc, should easily smelt in wood-fired reverberatories, and make a 65 to 70% copper matte in one operation.

While on this subject I should like to say that, in my opinion, the generally accepted explanation of the reason why zinky ores give so much trouble in the lead blast-furnace, is wrong. During the last few years I have seen that reason given by different writers in your paper, namely, that the zinc makes a heavy thick slag, which will not run, and forms sows and accretions that will not melt. Thirty odd years ago, when I began lead smelting, I was taught that also, and accepted it as correct, and my experience showed that those things certainly happened, and that only with difficulty, and very slowly, could a furnace be run with even 15% of ZnO in the slag. Later on, when I saw the fluidity of high-zinc slags in the reverberatory furnace and the bad effect of sulphur, I began to puzzle the thing out in my own mind, and finally formed the notion that it was the sulphur that somehow caused the difficulty in the lead blast-furnace, and that, if all the sulphur could be eliminated beforehand, the blast-furnace would make as easy-flowing and as fluid slags as the reverberatory. So I erected a plant and tried it, and found that I was both right and wrong. With scarcely any sulphur in the charge (almost no

matte was made, and what was made ran very high in copper; the furnace started like a racehorse, and the slag ran like water (it carried over 17% ZnO) for a shift; then quite suddenly, a change took place and the usual symptoms appeared, the disease galloped along at a great rate, and at the end of 24 hours the furnace was waterbound. The charge had to be cut out, but, to our surprise, we found neither sows nor accretions. So we tried again, and again, and always with the same result: at the end of a certain period the same symptoms appeared and the fire went out' for that is really what happened.

We invented all sorts of explanations, but soon noticed that increased fuel, and increased lime flux accentuated the trouble, and then I noticed, when cleaning for a fresh start, that the coke in the middle of the furnace appeared as if it had been dipped into a bucket of whitewash. It was, in fact, covered with zinc oxide, and so choked as to prevent effectual contact of the oxygen of the blast with the carbon of the fuel. Eureka! So, at once, I made no more attempts, having spent $40,000 of my own and my partners' money (chiefly my own, let me say), in finding out "what any fool with a knowledge of chemistry would have known before".

After the fiasco I hunted through my books again, and at last found, on page 20 of M. W. Iles's 'Lead Smelting', the following: "The decomposition of sulphide of zinc by iron produces metallic zinc, which burns with a blue-white flame in the upper part of the furnace to an oxide, and coats the furnace-walls, as well as the ore, and a part of the fuel, causing it to burn irregularly, if at all." So it was all known before, and I had read it several times, but had not the sense to apply it.

In smelting zinky ore in the lead blast-furnace all goes well while clean coke can reach the smelting-zone, but, soon the zinc liberated by the fuel and flux rises and oxidizes and deposits itself on the coke coming down with succeeding charges, and when the fuel reaches the smelting-zone its pores are more (with high zinc) or less (with low zinc) clogged by zinc oxide, and it burns more slowly; in consequence, the temperature falls, the slag becomes pasty and will not run freely; the usual symptoms appear and increase, until the furnace has to stop, or is run down, barred and started again, filled up with a lot of charges mixed with clean coke, and the cycle is repeated.

If the zinc in the charge is in the form of silicate and the ore already contains enough combined lime to form the slag, the furnace will run many days before clogging, although the percentage of lime may be very high—I don't know how high. Probably the success of the Huntington-Heberlein process on high zinc-lead ore is due to the fritting, which converts the added lime into silicate, and renders it no longer available to reduce the zinc to the metallic state in the subsequent smelting. No doubt this accounts for the success, too, of Bartlett's furnace at Cerro Gordo years ago, he fed his fuel through a slot on the level of the smelting-zone, or just above it, and so had always clean fuel. I have been told that the Japanese have furnaces which feed the fuel at the tuyere-level, and if so, they ought to be able to run high zinky ore through blast-furnaces, if they keep the sulphur low; probably they do.

I see no reason why powdered coal blown through the tuyeres should not succeed in smelting zinky lead ore in the blast-furnace, other conditions being suitable.

EDGAR HALL.

Silverspur, Queensland, September 15.

Concerning Strikes

The Editor:

Sir—In the voluminous current literature telling us about our present troubles, and those on the way, it is a relief to pick up a stray fundamental idea that looks as if it could be a stepping-stone to better conditions. We know that we are in trouble all right, but what we all want more to know is something of a concrete, curative nature to do about it. Preaching economic sanity is one thing we can all do; and trying to hammer into people a sense of personal, individual responsibility for whatever governmental and social conditions exist is another—this to begin back of the elections to public office, back even of the primaries—in the selection of real representatives instead of job-hunters so that ours may become a representative government in fact and not in name only. But after getting real representatives we must have a program, and we should be formulating distinctly in our minds the things that we want carried out. What specific thing, for instance, do we really think should be done to improve the relations of labor and capital and bring about that mutual confidence, the lack of which is the cause of so much of the present trouble in the world?

It seems to me that the editorial 'Concerning Strikes' in your issue of October 12 contains an idea that should go into such a program and become one of the planks of a platform upon which we should ask our representatives to stand. Referring to the frequent breaches of contracts and agreements on the part of labor unions you say: "The only cure for that is to pass legislation compelling labor unions to incorporate, so as to render them responsible for breach of contract, and then to hold the companies and the unions impartially to the observance of their obligations." The proposition is so manifestly fair and reasonable that it should be only necessary to state it to secure acquiescence. It has been stated before, and the wonder is that it has found so small a place in discussions. Over 17 years ago I addressed a circular to striking employees which contained the following: "If a majority of the men working for this company should see fit to form an organization, duly incorporated under the laws of the Territory so as to make themselves amenable to the same laws that apply to this company, in other words become as a body financially responsible for their acts so that they could be dealt with on a business basis, such an organization could rightfully present its claim to recognition and expect to be dealt with on the same

terms as any other incorporated body. It is unreasonable, however, to expect the recognition of an organization which does not even declare the identity of its members in advance of its demands and whose members have so little faith in their ability to defend the legality of their acts as to fail to place themselves in a position to be compelled to do so in the same manner as this company is compelled."

It seems to me that in again raising this question of incorporation a distinct service has been rendered and a tangible, definite thing proposed that can be the object of endeavor. One-sided contracts never work. The restraints of definite enforceable agreements are needed for both sides. Without them the appalling waste of the accumulated capital of the world, which accumulation has brought the average well-being of men up to a point never reached before, will go on to exhaustion, with inevitable retrogression to the suffering of a fierce struggle for existence through which we have come up, perhaps many times, like the working over of the rocks in geologic ages. The question seems to be, is man's intelligence yet sufficiently developed to make him see that his position can be held and advanced by orderly methods well within his grasp, or must he again go through the weary cycle of disintegration and re-building? The engineer, being one who "organizes men and directs the forces af nature to the uses of man", must do his part at this possible parting of the ways.

W. F. Staunton.

Los Angeles, October 29.

Mill-Tests v. Hand-Sampling

The Editor:

Sir—I appear to be unfortunate, either in failing to express my meaning clearly or in not receiving careful reading of my words. Your editorial on my letter published in your issue of August 2 indicates one of the above two things. This question of arriving at sampling-errors is obviously of prime importance in estimating the value of ore deposits. I feel therefore that I am justified in using further space in making my points clear.

The editorial infers that I consider the limits of 8% to 10% to be the safe ones within which the method under discussion can be safely applied. This again infers that outside these limits I do not think the method would be safe to apply. I mean nothing approaching this, and in re-reading my letter I cannot see how it can be read in that way. Such a contention would to my mind be absurd. If the method can apply only to such a narrow limit of difference as 8% to 10% it would certainly not be applicable to the majority of deposits. It is indeed more especially on deposits where the discrepancies between bulk and hand samplings would be large or variable that the method would be most needed as a corrective on hand-sampling.

Let us briefly review the points: Mr. Morton Webber set out a method of utilizing bulk samples to secure sampling-errors to apply to hand sampling. His diagram indicated that his idea was to divide a deposit into a number of areas, each one of moderate dimensions. Each one of these areas was given a sampling-error on the strength of one bulk-sample. These sampling-errors varied from 8 to 25%. There are other points, but as there is no disagreement or misunderstanding on them, we can omit them here.

I submitted (and submit) as follows:

1. That 25% is an enormous discrepancy and that I should myself not be prepared to accept it, on the strength of one bulk-sampling, as a discrepancy to apply to a considerable body of ore, that is, without verifying the result by other comparisons.

2. That the idea of subdividing into areas did not appeal to me in itself.

3. That areas could advantageously be utilized if they represented different natures of ore, but otherwise I could not see the principle.

4. That a more logical method would be to choose a few places representing the whole of the ore of one nature in a deposit—or representing the whole deposit, if its ore were of one nature.

5. That supposing three bulk-samples were taken at three such chosen places, then, if these three agreed closely as to the discrepancy between bulk and hand sampling (I suggested 8 to 10%, this being a common degree of sample-error), the average of the three might be accepted for the whole of the said ore, without further tests. That, if these tests gave more variable discrepancies (I supposed 5 to 15%), it would not be satisfactory to stop at that number for purposes of obtaining an average, but to make further comparisons, until the facts brought to light were considered sufficient to warrant a sampling-error being calculated and used. This is totally different from the inference in the editorial.

I said that Mr. Webber's method of areas might be claimed to give the same effect as averaging the discrepancies, that it resulted in averaging them, but in a different way. To this I pointed out that if the principle was that the sampling-errors might be inaccurate for the individual areas but that the number of them would introduce the law of averages, then, with areas of approximately uniform width, the effect of the two methods would be much the same; that, however, if the deposit varied greatly in width, then the method of separate areas might give results very appreciably differing from the true average. It would be superfluous to elaborate this fact.

Regarding the preceding paragraph, I am not clear as to whether Mr. Webber's method infers that each bulk-sample is taken as representing the area by itself or whether he relies on the law of averages to yield an accurate result for the deposit as a whole. It appears to me that to have a considerable number of areas, and to do the bulk-sampling so that the sampling-error for each can stand by itself, would entail a great deal of work and that this work could be lessened on the lines I have outlined. I have inferred that this is not his intention, but that the number of the areas would check inaccuracies in the individual areas.

I say above that 8 to 10% can be taken as a common degree of sampling-error. This remark applies only to actual error in sampling and does not include lowering of grade by admixture of wall-rock. My own experience has been that about 12% is the commonest degree of error as compared with actual contents of the ore mined. The degree, however, varies considerably.

Having arrived at the sampling-error or errors to be used, the additional allowance for inclusion of wall-rock must, of course, be a matter for personal judgment, based on experience, on the method of excavating, and the nature of the country-rock.

H. R. SLEEMAN.

Perth, Western Australia, September 26.

A Steel Industry on this Coast

The Editor:

Sir—Through the columns of your publication I would like to make a few remarks on the steel manufacturing industry on this Coast.

I have lived on the Coast now since 1909, and have been associated with people who had the ambition to inject the incentive into industry, to get a steel industry organized and on a paying basis. In some directions this has been an accomplished result, as may be seen by the representative steel plants in Portland, San Francisco, Los Angeles, and Seattle. There are certain products, now purchased from Eastern mills, that could be produced on this Coast. There are several known reasons why they are not produced here, to be sure.

In parallel with the present going concerns, there exists an element of some magnitude, always attempting the experiment in producing steel. Why is it necessary to experiment, in producing steels, when we have such tried and proved methods of doing it, and when all that is needed is a greater perfection of the present existing methods? The general trend is to try and produce steel direct from the ore in one stage process. I won't say "It can't be done", but I will ask, "Can it be done economically, and profitably, and can the product be guaranteed uniform in chemistry and properties, and does the direct reduction process have any advantage over the scrap melting method?" If these questions *can* all be answered in the affirmative, even then, why not start the plant on well known and tried processes, to assure the investors the proposition is a business one; and then perfect later the newer process, if it has the virtues claimed?

Would it not be more profitable, on this Coast, to produce the raw pig first, and to develop a supply of raw material? This is really what is needed, before a healthy steel industry can be developed. Why not use our available iron-ore resources for the production of pig metal, which is really needed here? The direct-to-steel process surely must cost more than the reduction to pig. So it cannot be said that the cost interferes. Steel scrap is nearly getting scarce on this Coast. What does it mean? It means a greater tonnage of virgin metal is needed to support the steel industry, if it is going to make products here instead of purchasing cheaper from Eastern mills. The reason they are cheaper in the East is because of the tonnage produced and the absolute availability of the raw materials. Could not some of the efforts be extended to these requirements, instead of trying something new, uncertain, and unprofitable?

R. C. GOSROW.

Seattle, October 24.

Dutch Guiana

The Editor:

Sir—With at least part of your editorial on Dutch Guiana, appearing in your issue of August 9, I must take exception. When you say "Dutch Guiana is good neither for the health nor the purse of the American miner", I assume that you do not know the health situation here as it really is. Hollanders, Englishmen, and Americans have lived in this country for years without showing any ill effects of the climate, and, while near the equator, the heat is never felt here as in New York, Chicago, or St. Louis during the summer time. A sunstroke is not known. During the Spanish influenza epidemic, not one white foreigner died in the Colony.

One American mining company employs, on an average, nine American engineers; they are 160 miles from Paramaribo in the bush, engaged in surveying and preliminary work that keeps them out all the time, in all kinds of weather, yet they are and have been well. I think that a comparison of the health conditions of this Colony with any of the American camps in their early stages would show that an American miner can live and work here as well as in most places.

As to the purse of the American miner, this is quite another thing, but I have had experience of this Colony since 1898, and have seen miners (?) of all sorts and conditions come and go; they ranged all the way from chiropodists to real-estate boomers, but real miners have been few and far between. There has been but one serious effort made by Americans since I have known the Colony; this company is still here; it has prospected large areas containing high-grade bauxite and seems to be pleased with what has been found. So far this company spent around one million dollars on prospecting, obtaining ground, and construction. The gold-quartz possibilities have hardly been looked into, and what gold is produced has been won by hand-work from placers.

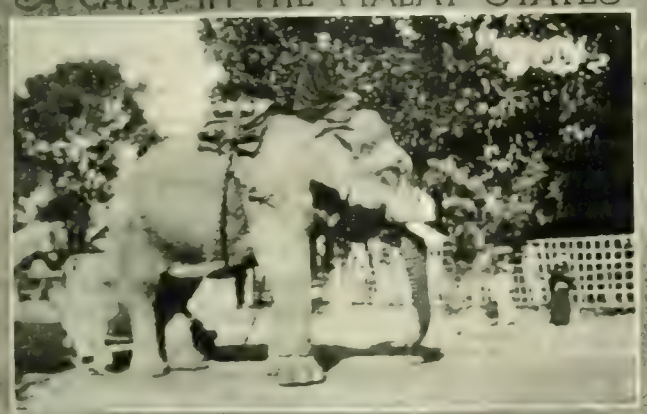
AN AMERICAN.

Paramaribo, September 18.

THE FAIRBANKS DISTRICT, in the Yukon basin, has produced over $70,000,000 in gold and has been a source of considerable silver, lead, tungsten, and antimony. The conditions in the district in 1917 are reported in a paper by Theodore Chapin that forms part of Bulletin 692-F of the U. S. Geological Survey. Mr. Chapin gives an account of the operations at the gold and the silver-lead lodes and at the tungsten deposits.

A CAMP IN THE MALAY STATES

THE AUTHOR'S SEDAN CHAIR



ROAD-MAKING IN UPPER BURMA

A CHINESE CROWD

TYPICAL KOREANS

Mining Engineering in the Orient

By GILMOUR E. BROWN

The Yangtsze river, rising in the highlands of Thibet and flowing eastward through central China, divides that country into two nearly equal portions, the peoples of which experience difficulty, from time to time, in living in harmony. Peace delegates, quartered at Shanghai, have for more than a year attempted to adjust, with but little success, the differences existing between the military party of the North and the progressive party of the South.

When civil war was being waged, trains full of troops were in constant evidence moving to and from the scene of military operations, but trains of wounded were conspicuous by their absence, leading to the conclusion that the Chinese excel in conducting warfare on humane lines. China swarms with soldiers and these by appropriating the grain and foodstuffs of the peasants, without payment, have been the direct cause in several provinces of the rise and increase of brigandage.

The traveler makes his first acquaintance with the soldiers in the dining-car of the long-distance trains, for although there may be accommodation available in the second and third-class cars, that is not good enough for these 'braves'. It is not conducive to comfort during train-journeys to find these lousy bipeds reposing at length on and around the tables of the dining-car, spitting on everything and anything within range. The Chinese director of one of the railways, who is also a general in the Chinese army, could not persuade the soldiers on one occasion to give him a seat in the dining-car until he had changed into his general's uniform, a situation which the foreigners present appreciated with rare relish.

A few days after leaving the terminus of the railway

or steamer route the traveler will renew his acquaintance with the soldiers, for the magistrate of each district through which he passes will insist on the traveler taking an escort of from 4 to 50 soldiers, the number depending on the magistrate's estimate of the number of brigands along the proposed route, and of the importance of his visitor.

With some experience of the country, it is possible to slip away from the escort in the early morning, but that is denied the stranger. The traveler too has to pay the wages of the escort, amounting sometimes to half a peso per day for each man. These soldiers are armed with ancient rifles. I have seen some dated 1869; and it is probably respect for the age of their weapons that leads the Chinese soldier to fire always from the hip without any aim at all. Sometimes it will be found that only 10% or less of the abundant ammunition carried by the soldiers around their persons will fit their rifles; their martial appearance is supposed to overawe the brigands and afford thus the necessary protection. Two American railway engineers were captured by brigands about two years ago, one escaping after three weeks, the elder and chief of the party being released after five to six weeks captivity. Both suffered severely from the continual night marching to elude the pursuing soldiers and the lack of suitable palatable food. Far in the interior a few soldiers are useful in restraining the ever-present crowd, which assembles rapidly to see and stare at the foreigner, and to permit of the examination of surface mine-workings.

Without a few soldiers it is next to impossible to take a meal or a rest except in the midst of a crowd of rustics whose habits leave much to be desired. This is perhaps the most unpleasant feature of travel in the interior of China. Unfailing patience, good nature, a ready sense of humor, and an angelic temper are essential for such travel. In a province where the natives are not particularly friendly, it is wise to avoid the villages and stop over-night at hamlets just sufficiently large to house the caravan. The lack of privacy, the overwhelmingly nauseating smells, and the vile places in which one must sleep, all combine to get on the nerves of the traveler and weaken his self-control. Above all, no cause must be given for increasing the mob excitement by the use of force or the display of firearms.

Traveling in the northern part of China is more pleasant than south of the Yangtsze, owing to the existence of roads along which it is possible to travel in carts, on horseback, or in a mule-litter, while the smells so characteristic of the South are neither so numerous nor so overwhelming. There are also fairly clean temples where one can rest in moderate comfort and privacy.

South of the Yangtsze, roads, where any vehicle other than a wheelbarrow can travel, do not exist. Usually the road is from two to four feet wide, forming a dike between rice-fields and paved with flat stones showing the wear of centuries. Each farmer seems to have had the right to move the road around his patch of land just as he pleased so that the frequent bends and right angled turns add from 20 to 30% to the time and length of the journey.

The Chinese are expert in the manipulation of a wheelbarrow and it is not an unusual sight in Shanghai to see from 10 to 12 Chinese women being conveyed home from their work in the cotton-mills on a single wheelbarrow. The traveler's baggage, however, is generally carried suspended across the shoulders of coolies, each coolie taking from 80 to 100 pounds and walking 20 to 25 miles daily.

The traveler himself in the southern part of China, while away from the rivers navigable by small junks, invariably travels in a sedan chair carried by two or four coolies. After three or four weeks of such a conveyance one makes up one's mind never again to grumble at a train being late or swear at the uncomfortable jolting of a mule.

The average Chinee, without as much as the flicker of an eyelid, can romance about his mine so as to lead the engineer into undertaking some unpleasant and barren side-trips.

Travel in Japan or Korea is as different from travel in China as the nebulous heaven of the missionaries differs from the vaporous hell of the same visionaries. The Japanese race is one of the cleanest as far as, and only as far as, personal cleanliness is concerned, while the women are neat, cheery, and pleasing to the eye. The Chinese peasant woman, on the other hand, with her stilted small feet, ungainly gait, trousers, flat figure, raucous voice, and lack of good looks is an outrage on womanhood.

The Japanese inns are neat and clean, but terribly cold in winter, particularly in the higher latitudes of Japan and Korea, where the Japanese persist in building houses of the type common in the more genial climate of southern Japan. All the traveler has to warm him in a room made up largely of doors, covered with rice-paper, and windows, are three or four tiny pieces of charcoal in the centre of a large pot of fine charcoal ash. Too close attention to the heating apparatus results in a vile headache accompanied by a lowering of the vitality through absorption of carbon monoxide in the blood.

The Korean, on the other hand, has developed a heating system similar to that used by the Chinese in their sleeping-floors, with the difference, however, that the Korean utilizes the waste heat from his kitchen-fire by leading it under the floor of his dwelling.

The bathing arrangements at the Japanese inns are certainly novel and extremely interesting to the student of nature.

Japan, three years ago, passed a law allowing only Japanese or judicial citizens of the Japanese empire to acquire prospecting licenses or mining leases in Korea, a contravention of treaty rights which drew a protest from America alone. Japan has not yet announced that this law applies to the Chinese territory of Manchuria.

In a previous article* I have dealt with the popular idea concerning the extent of the mineral resources of

*'Mine Development in China', 'M & S P.', May 17, 1919.

A REST HOUSE

THE ESCORT

China and the difficulties encountered in carrying out mining operations there.

The Malay peninsula, extending from Burma to Singapore, is rich in metals, particularly tin and tungsten. The tin-tungsten belt begins in Eastern Burma and passes through Lower Burma, Lower Siam, most of the Malay States, ending finally in the Dutch islands of Banca and Billiton.

The real tropical jungle begins in Lower Burma and covers all the islands of the Malay archipelago as far as the south of Borneo and the Celebes. Exploration in such jungle is one of the most fascinating branches of professional work and at the same time one of the most risky, if precautionary measures with regard to health are neglected. Life in the towns of the tropics is not injurious to the health of men, but the traveler in the jungle is exposed to 101 dangers of which the town-dweller lives in ignorance, and it is necessary for him to be constantly on his guard.

Malarial fevers have to be continually contended against and lucky is he who escapes them. In moving into a district noted for its malaria it is advisable to fortify oneself a week or more beforehand by taking increasing doses of quinine until the blood reaches a state of saturation, and this should be maintained until a week or so after a return to civilization. Care has to be taken to prevent chills or other temporary illnesses likely to lower the vitality, which would have the effect of allowing the malarial microbes in the blood to get the upper hand.

If the traveler fails to take quinine, he is liable to be seriously ill when first attacked, and there is no more unpleasant situation than to lie in that condition alone in the jungle, days, or perhaps weeks, away from medical assistance. I am no arm-chair theorist, for I write from seven years experience in tropical work.

It is a curious but well-established fact that in the Malay States the swamp-land is often more healthy than the foot-hills. This is due to the presence in the ravines of the foot-hills of a mosquito carrying a deadly type of malaria. This is so well recognized in that country that dwellings are now erected in the flat swampy land bordering the foot-hills.

Colonel Gorgas has shown that a mosquito rarely makes a flight of over 200 yards unless aided by the wind. By making a clearing around the permanent camp, and burning off the growth during the dry season, together with precautionary measures to prevent the mosquito from breeding in the near vicinity, it is possible to live in comparative comfort during rest hours. A little incense-burning under a table keeps the mosquitoes above the table, where they are more readily detected and killed. The Malays in some districts burn smoky fires under their dwellings at night to keep the swarms of mosquitoes away, but sleeping in such an atmosphere is far from pleasant. In some swamps the mosquitoes are so numerous during the day-time that life is almost unbearable, and it is necessary, if drilling in these swamps, to build several smoky fires around the drill-hole and to keep within the smoke-zone. When bathing in the rivers or streams, immunity from mosquitoes can be secured by the use of a strong carbolic soap.

The Malays make their dwellings on the banks of rivers or streams, and as these are more often polluted than otherwise, the traveler should make up his mind not to drink water except after it has been boiled, and to firmly adhere to this rule. While marching or moving camp, the best arrangement is to have the cook boil water in the evening, so that in the morning it has cooled sufficiently to allow of filling up thermos-flasks or water-bottles of sufficient capacity to last through the day. Passing through a Malay village nearly mature coconuts can be secured at any season of the year, and the milk from one of these makes a delightful and safe drink, particularly if made effervescent by the addition of a little brandy.

Physical fitness is essential to tropical exploration, for only in the vicinity of villages not far from the coast can any sort of conveyance be had, usually a cart drawn by two bullocks or water buffaloes moving only during the night hours at 1½ to 2 miles an hour. In Lower Siam or Burma, elephants can be hired cheaply to convey one to

the villages near the base of the mountains. They do not, however, make comfortable carriers.

Usually the traveler journeys up the rivers as far as he can in a dug-out; often it is possible to proceed in this leisurely fashion for a week or more, and then set out on foot for the mountains. The Malays cannot carry heavy loads and I have found it advisable to give each carrier only 30 to 45 pounds contained in a kerosene-tin, fitted with a lid to exclude rain, and strapped to the carrier's back. It is generally advisable to start at sunrise and end the day's march between 2 and 4 p.m.

In the jungle the sun is rarely seen through the tangle of vines and creepers around the high trees. The dark damp atmosphere, caused by absence of sunlight, is very depressing. A clearing on the banks of a stream should be chosen for camping, so as to get the benefit of the sun during the afternoon.

A small house, say, 10 by 8 ft., with a raised floor of saplings or sheets of bark, and sides and roof of bark or palm leaves, can be erected by half a dozen Malays in a few hours. In some jungles there is a low palm that has huge corrugated leaves, often 6 or 7 ft. long by 1½ to 2 ft. wide, which furnishes excellent material for house-building.

All the inhabitants of the jungle travel along the lines of least resistance; that is the reason why when an elephant trumpets the alarm to the herd on detecting a human being, it is highly desirable to get off the track in the least possible time. The frog, too, travels along the track and so does the snake, in pursuit. When the snake catches up with the frog it coils up and sleeps until the period of digestion is over. Walking Indian file through the jungle, it is advisable to go third and enjoy to the full the efforts of the first two men to jump clear of the disturbed snake.

On beginning jungle work, one is apt to be scared by the snakes seen two or three times daily, and, in addition to wearing puttees, one should carry potassium permanganate and a hypodermic needle or sharp knife for treating bites. Familiarity breeds contempt, and these are soon discarded. With one or two exceptions, snakes will make way for the human being, but if there is any tendency to dispute the path a well-directed handful of the moist earth is usually a sufficient hint.

The Malayan tiger is a cat of sufficient size to earn respect but he is cowardly. He will not attack two men and rarely one while in motion during daylight. While walking alone, he becomes a nuisance from his constant attention, waiting for an opportunity to catch the traveler when his back is turned, or kneeling, or lying down. A tiny fire, however, keeps him away. In camp, particularly if sleeping in an open tent, a light should be kept burning during the night.

In some parts, leeches are numerous and constitute the real pest of the jungle. Puttees then are a necessity and constant care has to be taken to ensure that the leeches do not enter beneath one's clothing. They are usually small, about 1½ inches long by ¼ of an inch in diameter, inflating with blood to over ½ of an inch in diameter. They leave sores difficult to heal and often bleeding freely for hours, particularly if the leech has been brushed off before finishing his meal. Siam pos-

BUILDING A HOUSE IN THE JUNGLE

sesses some huge water leeches, six inches or more in length, which are in such a hurry to get at the traveler that they will frequently attach themselves to iron or wooden articles held in the hand.

DRILLING IN THE JUNGLE

A strip of clean sand around the camp will keep snakes out, but it is highly desirable to raise the floor of the dwelling a few feet above the ground. This makes a healthier and cooler dwelling, with less likelihood, espe-

cially in the Malay States, of finding a scorpion in or beneath one's boots. A Malayan scorpion reaches seven or eight inches in length, and a sting means hell either here or below.

The most difficult work in the Malay archipelago is geological mapping, usually for oil, of the Tertiary strata forming the first high land to appear from beneath the extensive coastal plains. These strata are usually so soft that outcrops are rare and not easily found under the luxuriant growth. One well-known British geologist, the author of a book on oil-finding, gives his opinion that pit-sinking to ascertain the inclination of strata is unnecessary and an indication of lack of technical ability. I have mapped lands in several parts of the East Indies where outcrops did not average one to the square mile, and he must indeed be a super-geologist who can work out other than the most simple structure from such scanty data. The jungle in such territory appears so dense and formidable that the young geologist, detailed to make an examination, is appalled at the magnitude of the task and the difficulty of determining where to make a beginning. The streams usually afford the only rock exposures, but after these have been examined and mapped a great deal may be deduced concerning the topography and geology of the district. If indications are encouraging, tracks are set out in a definite direction, determined by a study of the drainage system, and these are cut under contract by Malays or Dyaks throughout the area to be examined.

A small house for the geologist and another for his coolies are erected near streams every few miles and these made centres for detailed work. Finally, pits are sunk from 10 to 30 ft. deep to determine the inclination of the strata at important points and to allow of the completion of the geological picture.

It is a fairly strenuous life, but a little relaxation in the way of a hunt after wild pig or deer, or a chance encounter with a tiger, adds to the enjoyment of the life and relieves the monotony of living alone in the jungle.

THE COPPER PRODUCTION of Alaska in 1918 was 69,224,951 lb., valued at $17,098,563, according to a report just issued by the U. S. Geological Survey. This is less than the production in 1917, which was 88,793,400 lb., valued at $24,240,598. The reduction in output is stated to be due to shortage of labor and ships. During the year 17 copper mines were operated, the same number as in 1917. A copper prospect on the Alaska Peninsula is under development, and interest still continues in the deposits of the Talkeetna and Broad Pass districts. The copper deposits in the Alaska range recently reported are still attracting attention, although little work has been done on them. The deposit of copper discovered in 1915 on Rainy creek, a tributary of the South Fork of Delta river, 7 miles above Miller's roadhouse, is said to be a large body of low-grade ore on which considerable crosscutting has been done. There is also a low-grade copper deposit in the gulch 1½ or 2 miles west of Paxson's roadhouse. A copper lode on McLaren river, tributary to the Susitna, is said to be 10 ft. wide and of high grade. It was reported that an outfit was to be taken in on the snow in the winter of 1918-'19 to prospect this deposit.

Mining in Canton District, China

During the past year wolframite ore in China was mined and marketed in large quantities. The demand for tungsten-steel created by the War in the United States and Europe led to the general development of this ore. At present production has almost ceased, owing to the decline in price, which in some cases has become less than the cost of production. Shipments of ore were valued at 3,140,220 taels. Most of the veins are small, averaging about 2 inches in width. Mining the ore now requires extensive blasting. Antimony production has practically ceased, owing to the low price of the metal on the British and American markets. Most of the smelters are closed, the operators waiting for a better market price. As many of the antimony mines are remote from water transportation, the present low prevailing price wipes out all margin of profit.

Lead and copper have so far been mined in only a crude way to supply local needs. Most of the veins are small, and many difficulties exist in mining and transporting the ore. Iron ore is found in abundance in many districts favorably situated for water transportation and fuel. Some large deposits averaging 73% are known, with all necessary flux and fuel in the vicinity. A small amount of iron is being produced at present for native use. This product is a high grade of malleable iron and readily worked into agricultural tools. A small quantity is exported. Coal is found in many districts in Kwangtung Province and is mined in a small way. The many tests made show that the coal is of good quality for steaming or coking. The coal-mining industry requires only the investment of capital and favorable mining regulations to bring it up to a high state of production. Up the North River there is an abundance of a fragile semi-anthracite which is easily accessible. The analysis shows volatile matter 13%, fixed carbon 75%, ash 12%, and heat value 12,000 b. t. u. per pound.

Manganese is common in the Canton district, the deposits being large and easy of access. Due to the high freight-rates prevailing there has been no market for the metal. With favorable shipping conditions, there should be a good export trade in this mineral in the future. Molybdenum was produced in small quantities in many districts during the past year and marketed at good prices. The deposits of this metal are small and irregular, usually being found in pockets or stringers not more than 1 inch thick. Small quantities are also washed from alluvial sands. Graphite occurs in many places in small quantities, but no mining is being done. Lime is one of the common elements in the general formation of the mountains of Kwangtung Province, the limestone being bedded on a shale floor. Large quantities of the purer limestone are exported and some is used locally in the manufacture of cement.

Patents and Progress

By WILLIAM E. GREENAWALT

Introduction. Much has recently been written in the technical press about the use and abuse of patents. It is curious how the various suggestions for improving the patent laws, or for remedying existing evils, are patronizing to the inventors or savor of a socialistic readjustment. This attitude is usually limited to patentees of inventions. No attempt is ordinarily made to make the remedy conform with other laws pertaining to property or possession. Any readjustment that is not justly a part of a comprehensive whole cannot possibly stand the test of time. Special legislation is never a success. Patented inventions are no different from other forms of property, and the general laws that govern one form of property should govern every other form.

Patents as Monopolies. A great deal of confusion arises as to the nature of a patent. Only the ignorant, however, consider a patent as a monopoly. A patent, *per se*, is not in the nature of a monopoly, as the term is ordinarily understood. It is, to be sure, an exclusive possession, the same as a house, a mine, or a factory may be an exclusive possession, but exclusive possession of such a character is not a monopoly. If, however, all valuable patents bearing on a particular art are brought under one control or community of interest, then patents may become a monopoly. But this does not differ from other monopolies. The evils are the same; the remedy should be the same. One form of monopoly is as objectionable as another. All are opposed to the American ideals of government and of justice.

Patents as Property. An invention is intellectual property, and a patent for the invention is the same as a deed to a lot or a mine. The conditions for acquiring possessory rights to an invention are much the same as for acquiring possessory rights to a mineral deposit. Both are grants from the Government. There is this vital difference, however, that it is vastly more difficult to obtain a patent for an invention than to obtain a patent for a mineral deposit. If an inventor applies for a patent the literature and the patent-office records of the entire world are ransacked to be sure that the applicant is the first and original discoverer of the invention. He must be the original discoverer. An applicant for a patent to a mineral deposit need not be the discoverer. The deposit may have been discovered, located and abandoned any number of times, and yet the applicant for a patent can get valid title. If the same tests were to apply to the patenting of a mineral deposit that apply to the patenting of an invention, then a mineral deposit once discovered or located, would never again be open to valid location and possession: it would be public property forever. A patentee for an invention gets possessory rights for 17 years, the patentee of a mineral deposit, timber lands, or homestead, gets possession forever. Material property is more readily defined than intellectual property, and it is evidently for this reason that all kinds of erratic suggestions are made for governing patented inventions.

Socialism as a Cure. Strange as it may seem, many who are apparently opposed to any form of Socialism advocate socializing of patent privileges. It has frequently been suggested that the working of patents should be compulsory after a short period and that in some cases the Commissioner of Patents should have the authority, under certain conditions, to issue licenses in the event of disagreement or obstinacy of the patentee. This is practically the present condition in Canada. Surely the patentee of an invention should have as much right to his intellectual property as the patentee of a valuable mineral deposit. If a suggestion were to be made that all patented mineral deposits be subjected to the same conditions to which it is proposed to subject patented inventions, the cry would not be "Socialism" but "Bolshevism". It is not unusual for some men or interests to hold over a hundred patented mineral claims. Would those who advocate working of patented inventions also advocate the working of all the patented mining claims under the same conditons? If they did, and such a law were passed, it is certain that ownership of most of the patented claims would be jeopardized. It would certainly be the cause of endless litigation.

Patented Inventions as Prospects. A patent for an invention is a prospect when the patent is applied for; it is not a finished product. Many additional patents may be necessary to protect the inventor in the practical development of his germ idea. How could an inventor comply with a working condition for, say, 15 years on all the patents necessary to adequately protect his invention? It would simply mean that inventors, who are usually poor, could not protect their rights and most patents could be brought into litigation, and the inventor robbed of what little rights he has.

Poverty and Patents. Most of the great inventions have been produced by men in straightened circumstances. Few epoch-making inventions, in any art, were conceived by men of wealth, or as the result of research work by large corporations. This statement may seem far-fetched, but its truth will be clear on due consideration. Pioneer inventions are always the result of prolonged meditation. By meditation is meant the intense dwelling, in thought, upon an idea or theme, with the object of thoroughly comprehending it. Imagine the boss coming around and finding his research chemist or electrician with his feet on his desk and 'meditating', and especially if this were necessary for years, and then

not with the certainty that the problem would be solved. Research may state the conditions of a problem, but only meditation will solve it. The man who has a competent income is not likely to spend years of his time meditating when there is a good time waiting for him in travel, dinners, and entertainment. Invention means sacrifice.

The Socialistic Element in U. S. Laws. Few people realize the socialistic element, either actual or implied, in the laws of the United States that vitally affect a large proportion of the population. Some of the conditions are not only socialistic: they are positively bolshevistic. Take, for example, the case of a scientist—a doctor, let us say—who may spend a life-time and a fortune in the quest of a cure for tuberculosis, and is successful. According to the laws of the United States such a man could not obtain any protection for his discovery, nor could he get any reimbursement for his expenditures. He is positively compelled to become a public benefactor, even if he is brought to poverty. The medical profession would also consider it unethical for him to withhold his discovery or exploit it for a selfish end. Similarly, an inventor may evolve practical ideas that may revolutionize an industry or change the status or the outlook of a nation. At the end of 17 years all exclusive rights to his invention cease: it is declared public property. He has no asset, even, in the large sums expended to give his invention practical application. The scientist and the inventor are laboring under ultra (not 'anti') bolshevistic conditions. The bolshevistic principle appears to be, "What is yours is mine, and what is mine is yours". Scientists and inventors are laboring under the adverse conditions, which assume that "What is yours is mine, and what is mine is my own". Under present conditions, the thief who steals millions under the shadow of legality and the heir who inherits unearned millions as a privilege have infinite rights as compared with the highest type of workers that America has yet produced. It is always argued that the patentee, for example, has a monopoly of his invention for 17 years: that may be true, but so, for example, has the locator of mineral or other lands, and of the two the owner of the patented lands is more likely to realize adequate returns during the first 17 years than the owner of a patented invention. It usually takes from five to ten years to develop a good mine: it takes about the same to develop a good invention. The expenditure made to develop a mine or homestead is a more or less permanent asset: the expenditure made in developing an invention is entirely lost when the patent expires. At the end of 17 years, for example, the Government takes the patentee's invention, say, of mining and metallurgical machinery, and hands it over to the patentee of a mine, as a public benefaction. The inventor is deprived not only of his invention but practically also of the entire investment incurred in bringing the invention to profitable operation. The patentee of a mine not only has his original investment intact, but the value of his mine is greatly increased by the enforced benefaction of the inventor. "Verily, to him that hath shall be given and to him that hath not"—you know the rest.

Proposed Legislation. The Patent-Office is now asking for an enlargement of its powers. It should be given everything it has asked for. It has not asked for enough. In addition to the powers the Commissioner already has, they should, under certain conditions, be enlarged to stimulate invention. It is quite conceivable how the Government might with advantage to itself, and to inventors, assist in a small way in proving up the essentials of meritorious inventions, if an inventor can convince a board of inquiry of its probable merits. Think of the time, the money, and the litigation that might have been saved if Everson and Kirby could have had a little assistance in developing their inventions: for it must be evident to anyone that while the disclosure in the Everson and Kirby patent is somewhat indefinite, all the elements are there, and a little additional work would no doubt have evolved all that is necessary in modern flotation.

A great deal of money is spent annually by the Government in agricultural investigations for the benefit of the farmers; in the Geological Survey and the Bureau of Mines for the benefit of the miner; in river and harbor improvements for the benefit of commerce; would it be so awfully preposterous if the Government were to spend a little for the benefit of inventors? Objection might be made on the basis that many inventions do not merit any expenditure. That may be true. But a great deal of money is also spent in giving young men high-school and college educations: not all of these justify the expenditure. We all know, of course, that Emerson said he did not believe in educating fools at college, but Emerson, like other philosophers, gave us a lot of platitudes while failing to touch the essence: He did not tell us how to distinguish the fools. That is the real difficulty; just as the real difficulty is in distinguishing a meritorious invention from a worthless one. The best men in history have at times been classed as fools; the best inventions, in their undeveloped stage, as worthless; and the best mines, when prospects, as lacking in merit. In cases of reasonable doubt, nothing will decide the issue but the results under fair demonstration. Whatever assistance the Government might give inventors, it should not be on the basis of charity. It might take the form of well-equipped laboratories in various parts of the country with every facility for testing inventions on a small scale at cost. At the present time the Patent-Office is not even provided with an adequate laboratory to facilitate its own work.

A Technical Appellate Tribunal. One of the reforms contemplated in the proposed Patent-Office legislation, and one which is urgently needed, is a technical appellate tribunal of last resort to review patent cases, both of the courts and of the Patent-Office. The recent decisions of the U. S. Supreme Court in the flotation litigation emphasize the need for this. Their indefiniteness showed lack of sufficient technical knowledge. A second decision was necessary to interpret the first, and a third decision will be necessary to fully determine the second. The uncertainty of the "oil" and the "fraction

of 1% " in the first decision were settled in the second, but it is quite certain that at least another decision will ultimately be necessary to interpret the matter of "agitation". All of these issues should have been clearly defined in the first decision, and no one doubts but that a tribunal of legally trained technical men could have rendered such a decision, especially if one or two of the judges had been technical experts in the flotation art. The best judges of an appellate court are probably as limited in their grasp of technical matters as the best trained technical men are informed on matters of law, and it is not likely that any member of an appellate court would want to take a chance on the decision of well-informed technical men on points of law.

It is perhaps egotistical human nature that inclines a scientist to think he is capable of passing upon all matters of religion: an inventor to think he is competent to pass on all matters of law and ethics: a preacher to think he is competent to pass on all matters of politics: and a lawyer to think he is competent to pass on everything. A legal training does not make a man omniscient. It may afflict him with myopia.

In most cases of patent litigation an appellate tribunal is supposed simply to pass upon the law, but the law is easy when the facts are made clear. Nine-tenths of the difficulties in all patent controversies lie in differentiating one invention from another and from the prior art, and the men most capable of doing this are men skilled in the particular art to which the controversy pertains. A man skilled in optics would be a poor judge in controversies pertaining to chemical processes, and the chemist would not be a fit judge on electrical inventions; still, either of them would probably be as good or better than a lawyer with no special scientific or technical training.

In all technical and scientific litigation, it would seem the course of prudence and justice to have at least one or two men on the bench in important cases, men familiar with the practical details of the art to which the litigation pertains. It would not be necessary, nor would it be desirable, that the technical men should be permanent members of the court; but, rather, floating members, familiar with the details of the art pertaining to the specific case under review. The floating members of the court could be selected by the permanent members, either from a list submitted by the litigants, or with the approval of both litigants. Such a court should have the right to call independent experts, if desired, at any stage of the proceedings, but the experts so called should be subject to examination and cross-examination, like any other witnesses. It seems most unfortunate, under present conditons, that matters which may be vital to an intelligent decision cannot be considered because, either through neglect or misunderstanding, they were not included in the original testimony. An inventor would mend his fences as he goes along and get all the information he could to arrive at the desired end, but no additional light can be thrown on patent litigation after taking of the original testimony, even though the new information would be conclusive and enable the Court to arrive at a fair decision. The Court is the slave of precedent, and not infrequently it is obliged to give an unfair decision when additional testimony or evidence might aid justice. It is more than likely that the Supreme Court was hampered in both of its flotation decisions through this foolish custom. Invention involves advanced art, and if the judges want enlightenment on certain phases of a case, they should have the right to call for additional testimony to clear up obscure points.

In important cases, the patent Court of Appeals should have at least two technically trained men, expert in the art under consideration, and these expert judges should have the same responsibility as the regular judges composing the Court. They should not be regarded merely as technical advisers. When the technical and scientific facts in any patent litigation are clearly analyzed, the law pertaining to it is greatly simplified. No one could get a job in the Patent-Office as a primary examiner who has not got an extensive knowledge of the technicalities of the art in which he expects to work. Many, if not most, of the primary examiners are technical men first and get their legal training afterward. This is as it should be. In an appellate court no special technical training of any kind seems to be necessary to give important decisions. This is as it should not be. No judge can give an intelligent decision without a thorough knowledge of the art to which the case pertains. The primary examiner, equipped with the special technical knowledge of his department, is usually more capable of giving a fair decision in contested cases than an appellate judge, who has no special qualification for this highly specialized work.

No amount of skill and knowledge on the part of the primary examiner will obviate all patent litigation. The fault is not with the Patent-Office, but rather in the inherent nature of things. No invention is born in all its perfection out of a clear sky. The germ idea, with all of its haziness and impracticability, comes first, and then comes a long process of evolution. The inventor seeks to protect himself in the development of his work, and, necessarily, he cannot realize with any definiteness the scope, the limitations, and the possibilities of his invention. And if he does not and cannot fully realize it himself, the Patent-Office should not be expected to see what the inventor himself cannot see. The result is, that many patents and patent applications suffer for want of definition, and there is no remedy for this difficulty. How, for example, could a primary examiner avoid litigation on the flotation patents, when no two courts agreed on the merits of the case, and when the U. S. Supreme Court had to interpret its own first decision? In case of reasonable doubt the Patent-Office is right in allowing an application to issue. It is time enough to litigate a patent if it is worth while litigating. Litigation, however, should be greatly facilitated.

American and Foreign Patents. The patent laws of the United States are essentially fair, fairer than those of any other country. Many countries have working conditions with which few foreigners can comply. Usually the least progressive nations have the most.

drastic patent laws. Such countries seem to think that they gain by making conditions so that patents are easily forfeited and then become a public asset. As a matter of fact the asset is destroyed with the forfeiture of the patent. No one is going to exploit a patent purely for the benefit of the public. In all cases the incentive is the reward, if successful, and no one would be unwise enough to go through the agony and pitfalls of developing a new invention with the incentive removed. Even if an invention has been successfully developed in one country, there is always danger of subsidiary patents in introducing it into another country.

No conditions should be attached to an American patent, for citizens of the United States, that would make forfeiture probable within the 17 years of the life of the patent. Few men have done so much for the country as the inventors, and few have got less for what they have done. Our patent laws should be severe on all foreigners whose countries have laws more drastic than those of the United States. Foreigners from such countries should be required to pay a patent fee in the United States equal to the fee in their own country; if their country has a working clause, the same condition should be required; if a tax, a tax should be required; if a limitation of royalties, the royalties should also be limited in the United States. This would tend to make patent laws uniform in all countries. As it is now, a citizen of the United States, in his own country, has got to contend against all the inventors of other countries, while not having any tangible privilege in return. A foreign patent must usually be applied for before the American patent is demonstrated. Few inventors can take the risk, and few are in a position to maintain the working conditions and taxes frequently attached to foreign patents. The best way, of course, would be to have a satisfactory international agreement, but that would appear hopeless if taken up through the regular diplomatic channels. It is not likely that any beneficial results will be realized, by the patentees of the present generation, through diplomatic channels. It is possible that it could be realized through the League of Nations.

Piratical Litigation. A remedy should be provided for the protection of patentees from piratical litigation. Patentees, as a rule, are in no position to defend their rights against such tactics. A highwayman is a gentleman compared with the man who will force a patentee into unjustifiable litigation, and then get possession of his patents for a nominal sum through a forced compromise. This is a common proceeding for those who want to acquire a patent monopoly. Such questionable proceedings usually go under the high-sounding name of "business sagacity"; they should go under the name of "legalized theft". Law and justice may at times be total strangers; they may not even recognize each other when face to face in the courts. Most patentees are unable to get financial aid to develop their invention if the patents are brought into unjustifiable litigation, and most shrewd patent attorneys can bring almost any patent into question.

The mere fact that a patent is in litigation does irreparable harm to the patentee, even though his patents are justly unassailable. The moment a patent is brought into litigation, justly or unjustly, the patentee is practically put out of business, because few, if any prospective interested parties will have anything to do with patents that might at any time make them a party to the litigation, and they are hardly ever concerned with the merits of the case. If the patents are ultimately vindicated, there is nothing left but the hollow shell; the patentee cannot come back and sue for damages on business he might have had but did not get.

Difficulty in Exploiting Inventions. It is not an easy matter to get large financial interests to adopt, or to thoroughly test new ideas, if patented. This usually compels an inventor to organize a company for the exploitation and development of his invention, in which he usually has a small or minority interest. Such companies are heavily capitalized, not only for the exploitation of the invention, but also to protect them against piratical litigation. If the venture is successful, large salaries have to be paid and large dividends are expected on a large capitalization. Manifestly, royalties or compensation that would be satisfactory to the inventor would not meet the demands of a heavily capitalized company, and if a royalty charge is made to meet all conditions, the royalties must, necessarily, be large. Companies controlling valuable patents are just the same as companies controlling valuable mineral lands, or manufacturing enterprises, for example; they want what they can get out of it. If the royalties are excessive, no fault should be found with the inventor, for in most cases the inventor had no alternative; and no fault should be found with the companies controlling the patents, for they are doing what other companies do under similar conditions.

Everyone understands, of course, that all the patented schemes presented for consideration to the larger financial interests are not promising. Neither are all mining prospects, nor any other enterprises in embryo. It is quite safe to say that any expert to whom a patented process is referred, could safely turn down 95% to 98%, and be right, without even knowing anything about them, and still get a reputation for sagacity and discrimination. In doing so, unless he is unbiased and investigates carefully, he will also turn down the other 2 or 5%, which have merit, and later find that something of value has been overlooked. Such cases can be recalled without going into ancient history, and yet, in the metallurgical art, at least, these have come into great prominence in the last few years. It is probably true that every meritorious invention has been repeatedly turned down by leaders in the art to which it pertains. If then, the inventor persists and attains success and a high royalty charge is made necessary, no fault should be found with the patentee: he is entitled to what he gets, and he never gets anything he has not earned. It is not until after he has made a success that the literature of the entire world is ransacked to discredit him.

Within the last few years, however, some of the best

oil and gas companies have adopted a more liberal attitude toward patentees. Many of them feel that an inventor who presents anything worth while is entitled to fair compensation, even if his patents are not altogether impregnable. They feel that a liberal policy is the best in the end.

Rights and Privileges. Most of the present social and political unrest in the United States is due to the perpetuation of large fortunes. The American political doctrine of the Declaration of Independence, that "all men are created free and equal", may have been a living thing in 1776; it sounds like mockery in 1919. In the race for wealth, which seems to be the measure of success according to our present standards, it is not the keenest of intellects that wins. A turtle may win in a race with a greyhound if given sufficient advantage.

Wealth is not a true measure of worth: if it were, many of the scientists, the doctors, the lawyers, statesmen, inventors, preachers, and even the presidents of the United States would be among the wealthiest of men instead of being among the poorest. It does not require a vivid imagination to see the skeleton hand of the ghost of a dead millionaire coming out of the forgotten past and taking the scientist, the inventor, and other enforced public benefactors by the throat and saying to them. "Because ages ago I acquired a vast fortune either by intent or accident, honorably or otherwise, you and your posterity shall forever contribute of their earnings to support my posterity in ever-increasing opulence, power, and luxury". Humanity, after all, is more or less of a joke.

Probably 75% of all the social and political unrest could, in time, be eliminated by one simple law. The remedy is a drastic inheritance tax. The idea is old, and many of the best economists and jurists have favored it. Was it not Carnegie who said that "the man who dies rich dies disgraced"? Surely if it is right to deny the scientist any possessory rights to his discoveries or even his expenditures incidental thereto; surely if it is right to completely wipe out the property privilege of the inventor and patentee at the end of 17 years; surely if it is right to deprive the author and the musician of the exclusive possession of their compositions at the end of 28 years, it should not be wrong to enact a drastic inheritance tax to deprive the dead of something they can no longer use. Inheritance is a privilege; not a right. It is a privilege, exactly the same as a patented invention or a copyright, and if it is right to completely annihilate patents and copyrights during the life-time of the inventors and authors, it should not be wrong to greatly curtail the privilege of conveying property to others, by those who can no longer use it and to those who never lifted a finger to earn it. The American idea is, that a man should have what he earns; but the converse of this should also be stated: he should be made to earn what he gets.

Many attempts have been made to analyze the cause of the present social and political unrest. Many good thinkers believe that the material development of the world is too far in advance of the spiritual and political development. This is probably a good guess. To the average preacher there can be no new revelation. To the average politician, what is not tried is not true. If the material advancement exceeds the spiritual and political advancement, it may be attributed to past and present laws. How much material progress could have been made if the privilege of exploiting a scientific discovery or a patented invention were granted forever? The world is sick and suffering from inheritance privileges, whether of political power or of wealth, for, in the last analysis, they are the same.

It is a curious fact that in all political controversies between capital and labor, only organized capital and organized labor is invited to the conference. The man in the middle, the professional man, the lawyer, the educator, the doctor, the inventor, the small miner, the small manufacturer, the retailer, the farmer, who are slowly but surely being ground to death between the two great millstones of organized capital and organized labor, are not even asked for an expression of opinion as to what maner of death they shall die. Even the President of the United States in his recent call for a conference between capital and labor practically ignored both unorganized capital and unorganized labor. If present conditions continue, the people in between, who may be either capital or labor, will soon be a thing of the past. There will then be left only organized capital and organized labor. And after that? No, not the deluge, but a new and better order of things. Humanity is moving forward, not backward.

One of the few places where a plant has already been installed for the distillation of oil from shale is near Dillon, Montana. The shale at the site selected for the operations is a part of the Phosphoria formation, which contains the beds of rock phosphate that are mined at several places near Bear lake, in south-eastern Idaho, for the manufacture of fertilizer. Phosphate beds are also associated with this shale in the vicinity of Dillon, and although they are neither so thick nor so rich as the beds in south-eastern Idaho they have some prospective value. Soon after it became known that there was shale in the Dillon region from which oil could be distilled certain promoters began to organize companies to drill for oil in that region, and the search has been carried on persistently in spite of the fact that the geologic conditions there are almost wholly unfavorable to the occurrence of oil.

The first of these oil-shale beds was first brought to the attention of the public in a report by C. F. Bowen, published in 1918 as Bulletin 661 of the U. S. Geological Survey. A more detailed examination of these phosphatic shales and of beds of other formations that may contain oil shale was made late in 1918 by D. Dale Condit, whose report has just been published by the Survey as Bulletin 711-B, which is entitled 'Oil shale in western Montana, south-eastern Idaho, and adjacent parts of Wyoming and Utah'. Copies of this report may be obtained on application to the Director of the U. S. Geological Survey at Washington, D. C.

The Economic Education of Labor

By EDWARD A. BRADFORD

*"Experience keeps a dear school, but fools will learn in no other." The organized labor of our times is far from being composed of fools, but they are showing a preference for learning from experience rather than from books or counsel. They were graduated from the primary state when the spokesmen for the Railway Brotherhoods announced their discovery that increases of wages were not satisfactory, since the money had to be paid into the profits and costs of those from whom labor must buy the goods it needs to live on, and the process was repeated as often as wages were raised. What the Brotherhoods preferred was a reduction in the cost of living, so that they could keep some of the increased wages, and still have their share of the good things of life.

Even this primary lesson has not been learned by all labor, judging by the current statements that never were there so many strikes at one time as just now. The Federal Department of Labor has officially reported that in 1916-'7-'8 there were 11,092 strikes, and most of them in this neighborhood. In 1918 the New York State Industrial Commission reported that there were working days enough to make forty-eight centuries lost in strikes, and more still in 1917. If there are now more strikes than in wartime there is the greater need of labor's learning its second lesson in economics of how to get more for its wages, rather than how to get more wages. The second lesson, like the first, may be learned either from the books or by experience, and the wisdom of labor will be judged by its choice.

The essence of the first lesson of labor in economics is that wages, costs, and prices are so interrelated that when one is increased the other must be, too, if the accounts are not to show a debit balance. That is still in process of proof in our local traction strikes, after having been demonstrated to the Interstate Commission, and to Congress, respecting the steam railways. The budget-keeping of the families of the strikers is no different in principle, and the second lesson for labor to learn in economics is how it may have more satisfaction without losing the wages won by so many years of strife.

Costs and prices are related to production as well as to wages, and if production is increased costs are reduced. Then prices will be reduced by all except profiteers, and they will be hunted out of business and into jail. This seems to be a hard lesson for labor, since most present strikes are for reduction of time as well as for increase of wages. Most production nowadays is by machinery, and if machinery works slower, or shorter hours, the output is correspondingly reduced. That is also true in industries where output depends on hand labor.

The steam-railway firemen now are demanding installment of machinery to save their labor, as well as for other betterments of working conditions. That is only one example of how labor increases costs for capital, while also contending that "labor produces all and should have all it produces." Since the industrial revolution labor is reckoned by horse-power rather than by man-power. That is only another way of saying that capital saves man-power by providing a substitute. It would only be fair play that labor should spare capital unnecessary costs by using cheerfully in production the machinery which capital provides. The demand by the firemen for labor-saving machinery shows progress, for labor consistently for centuries has opposed the introduction of machinery on the ground that the introduction of machinery makes muscle-power unnecessary.

The books teach to the contrary. Thus, John Stuart Mill, one of the apostles of the dreary science, which labor prefers to learn by experience, said fifty years ago: "It is questionable if all the mechanical inventions made yet have lightened the day's toil of any human being." Labor-saving investments of capital make more work than they save. The reason is that human wants are infinite, and that there are new wants for every satisfaction supplied. It is said that Wall Street speculation will absorb all money allowed it. Just so the demand for goods will absorb all the labor in existence, and there never can be overproduction of consumable goods.

Labor gives signs of appreciating this in its insatiable and insistent demands for more goods for its wages, and then gives signs of ignorance of how best to attain that end by slacking in working hours, and by demanding shorter days. Thus the painters are asking for a five-day week besides higher wages, and the silk-mill operatives, after agreeing on wages, asked for both more pay and for shorter days. This is a failing of human nature rather than a proof of ignorance of economics by American labor. Thus the British Premier, in his speech last week regarding reconstruction after the War, said that labor's argument that production increased with the reduction of overwork, was not true. "There has been a substantial reduction in the hours of labor, and it has been found that the output has been reduced almost in the same mathematical proportion. It is a dangerous fallacy that the less men worked the more work there would be for others, and it is highly important for those having influence with the workers to do their utmost to explode this fallacy."

American experience has been to the same effect. The

*From 'The Annalist'.

National Industrial Conference reported in June the results of an investigation of the hours of maximum production in the metal industries. Even a 50-hour week "could not be universally adopted by these industries without some loss of production." If management and workers actively co-operated a 48-hour week could be used more generally, but "the general adoption of a 48-hour week in the metal trades would involve a serious economic loss to the nation." Of 66 establishments which reported reduction to a 50-hour week, "4 reported production as increased, 28 as maintained, and 34 as reduced." In March a similar report was made for the silk industry, to the effect that the point of maximum production is "somewhat nearer 50 hours than 54 hours per week." The silk workers are taking rather than asking for a 44-hour week. Shortening hours is less hindrance to production in the silk industry than in the cotton and wool, for the reason that the skill required is greater, and there is a greater opportunity for the worker to influence production by personal effort. In the wool industry production was maintained in only a small proportion of cases when time was reduced to 54 hours. In the cotton industries reduction to 54 hours "almost invariably involved a loss in production, and usually a substantial loss." When hours are shortened piece-workers maintain output, but time-workers reduce output.

It is useless to multiply proof of so plain a proposition as that it is not possible to raise wages to the maximum record and shorten hours, without increasing costs, reducing production, and defeating the object for which labor is striking while learning by experience. The present movement for easing the conditions of labor is cloaked as a movement for social betterment, and for humanity toward excess of work to a degree harmful to health and life, and therefore detrimental to society. So far as the movement is honest it is justified, but there is constant need of care lest it be perverted to the uses of the slackers rather than to those of true lovers of their fellow-men.

Where there have been cases of real excess of labor, as in the steel and coal trades, there has been reform, and even of reform to excess in the opinion of many workers, who would have preferred the larger pay with the longer hours. But industry should not be speeded up to the capacity of the strongest, any more than it should be slowed down to sub-standard capacity. Society needs all that can be produced without social detriment at all times, but especially when war has removed from production fifty million workers, and will return to industry less than half of them, many as cripples. For the next few years, at least, there is urgent need of the greatest possible output by all capable workers, regardless of sex or age. In no other way can there be such production of goods that supply shall exceed demand, and the overstocked market shall reduce its prices. All human wants will not be satisfied then, but the reduction of prices will do more to meet labor's demands for satisfactions within its wages than strikes for more play and higher pay.

Experience and the books suggest an alternative. Instead of inflation of goods—as desirable as inflation of money is objectionable—it is possible to break the price level by contraction of industry. Contraction of currency or credit is sometimes desirable, but painful, and always less so than contraction of industry. No able-bodied man need be idle now, and locomotive engineers are earning more than Governors of a baker's dozen of States. The disproportion between the pay of workers with hand and brain was never so great as now, and overpaid muscle is showing its brains by buying garments unsuitable for its daily life, such as silk shirts for negro field-hands or coal miners, and costly cars for iron-workers, while professors, colonels, and admirals are not able to keep their families comfortably, or sometimes even decently. But when industry is reduced by contraction those who now are troubled how to spend their money will be troubled to find jobs to earn wages to meet more modest wants. When contraction of industry is carried to the soup-kitchen stage, as it has been before, labor will once more have learned by experience that it is better to supply its wants by working to over-supply the goods market rather than by contracting the demand. Labor has its choice, but there is no third way.

There are two current examples of contraction of the demand for goods. Both are abnormal, because due to the War, but they illustrate how severe is the method of reducing demand to supply, rather than increasing supply to demand. Germany was so thoroughly blockaded and finally beaten that it was about the neediest nation, and for that reason emerges from the War among the most industrious. The cable has reported a Government proposal for a compulsory 10-hour day, with no maximum, and one hour as a gift to the Government. In that way Germany may yet win in peace what she lost in war. Industrially Italy is poorer than Germany, but she is rich in man-power, and the cable reports that several groups of railway-workers—will wonders ever cease!—have offered to the Premier to increase their hours of service in order to increase national production. During war there was no nation without examples of even greater sacrifices in all ranks of life, but where is there another example like Italy's in peace? Contrast with that, not merely our strikes, but even the declarations of our most conservative labor leaders.

Addressing the Pan American Conference, Mr. Gompers said that this time wages would not be reduced and hours lengthened, as has been the custom in every crisis, industrial, economic, or financial. That has been the custom of employers as their remedy for the misery of the people. With the understanding of the responsibility of his words he gave notice that the American workers will not be forced back by all the Bourbons in the United States. The time has come when the workers have new rights and advantages, and are going to enjoy the better times for which the whole world has been in a convulsion. Mr. Gompers declared that the Allies, conquerors in war, would extend throughout the world the advantages which their workers had enjoyed by wartime inflation, and the Republican Publicity Association en-

dorsed his declaration. Many would like to see that aspiration realized, but experience causes doubts. Never have prices remained long at any maximum. Always there has been reaction and reduction, and almost always by contraction. Now the statesmen of the world are pressing the alternative of inflation of production to match the inflation of the wage scale and the money scale.

There are sure and simple tests to decide whether strikes are meritorious in the public and individual interest, or whether they are motived by a predatory spirit of domination by combination. Strikers who ask both higher wages, and hours shorter than average workers are easily capable of doing, are coveting what they do not earn, and what they are not entitled to have without earning. It is a common fault, not calling for surprise or censorious comment, but the demand is not one to be conceded at sight. There may be others worse off than such strikers, and, therefore, more deserving of a helping hand if willing to help the public in turn by doing what others decline. The sign of that is that such strikers seek by threats and violence to prevent others from taking the jobs they abandon.

There is no objection to workers leaving work because underpaid. The laborer is worthy of all the hire he can command. But this is the privilege of all, not of unionists alone. Consumers have rights as well as producers, and in particular the right to get for their dollars all that they should command in a free market for both labor and goods. When the labor market is shut, or controlled by a combination for restraint of production, and increase of wages by duress, there is a case for the assertion of the law against domination by conspiracy under the guise of humanity. When strikes are followed by disorder it is almost sure proof that they are contrary to both law and public interest.

Mining in Utah in 1919

The metal output of Utah was seriously retarded during the first half of 1919 not only by the lower prices of copper, lead, and zinc that followed the curtailment of demand, but also by a labor strike at Park City. The State's output of gold, silver, copper, lead, and zinc in 1918, valued at $86,047,597, showed a decrease from $99,328,155 in 1917. Even if mining conditions improve considerably, output of all these metals will decrease in 1919. The smelters at Murray, Midvale, Garfield, and International remained active, but many of the furnaces at each of these plants were idle.

Gold. The value of the output of gold in Utah in 1918 was $2,949,170, a decrease from $3,355,156 in 1917. Most of the gold mines in 1918 came from the three main districts—Bingham, Tintic, and Park City—which produced, respectively, $2,056,005, $678,952, and $82,461 in gold. These totals were less than those for 1917, and those for 1919 will show a further reduction on account of a decrease in the shipments of ore.

Silver. The output of silver in 1918 was 13,455,597 oz., averaging $1 per oz., nearly equaling the output in 1917. About half of the silver (6,681,644 oz.) came from the Tintic district, which was followed by the Park City region, with 2,572,586 oz., and the Bingham district, with 2,056,005 oz. There was an increase of over a million ounces of silver from mines in the Tintic region, due largely to the high average silver content of the ores shipped from the Chief Consolidated and Tintic Standard mines. Park City and Bingham districts both had decreased outputs of silver, and in 1919 there will probably be further decreases in the output of these two districts, due to the prolonged labor strike at Park City and the curtailed production of copper at Bingham. There should, however, be no change in the Tintic district, because a new railroad branch now under construction will give the mines in the eastern end of the district increased facilities before the end of 1919.

Copper. Utah is credited with 227,169,630 lb. of copper, valued at $56,110,899, in 1918, showing a slight decrease from the output of 1917. There is a prospect of a decided decrease in the output of copper in 1919 on account of the reduced price of the metal, which was 15c. per pound in March. After March there was a general curtailment of production, especially at the Utah Copper property, which is the largest producer of copper in the State, having yielded in 1918 about 85% of the total. The production of this company for the first quarter of 1919 was 60% of that for the last quarter of 1918, and the average monthly output for the first five months was 9,500,000 lb. Improvements are being made at the two concentration mills of the Utah Copper Co., one of which has been closed since March. In 1918 the Bingham district produced 211,194,861 lb. of copper and was followed by the Tintic district, with 6,568,802 pounds.

Lead. The output of lead decreased from 178,521,958 lb. in 1917 to 167,008,224 lb. in 1918. The Bingham district produced 79,773,150 lb. of lead and was followed by the Tintic district, with 30,652,355 lb. and the Park City region, with 24,320,074 lb. As the price fell to about 5c. per lb. in May 1919, and the Park City mines were idle nearly two months on account of a labor strike, these totals will probably be greatly reduced for the current year. In February the Utah Apex Mining Co., a producer of both lead and zinc at Bingham, laid off 300 men awaiting better market conditions.

Zinc. The output of zinc was 21,286,871 lb. in 1917 and 18,399,417 lb. in 1918. Most of the zinc came from Salt Lake, Wasatch, and Beaver counties. There will be a general decrease in 1919, as the price is much lower and there is difficulty in marketing the product.

Dividends in the first part of 1919 were paid by the Utah Copper, Chief Consolidated, Tintic Standard, Utah Consolidated, Ontario, Eagle & Blue Bell, Judge, Iron Blossom, Daly, and Bingham Mines company. V. C. Heikes, U. S. Geological Survey.

The mining legislation now pending before Congress includes a bill to authorize the exploration for and disposition of coal, phosphate, sodium, oil, oil-shale, and natural gas on the public domain.

Platinum in Colombia

Colombia produces an average of 30,000 troy ounces of platinum per year, practically all coming from the Quibdo district. The high prices prevailing during the War greatly stimulated the production, and entire districts along the coast and rivers west of Cartagena were depopulated, the people emigrating to the platinum district to wash for platinum gold. During the fiscal year 1917-18 production in weight of metal fell off on account of the protracted dry season, the usual heavy rains of the Quibdo region not materializing. A great many more people were engaged in the work, but the production per capita was not normal with relation to former years, when prices were much lower. Water for washing the metal had to be collected during the night in small pits dug in the banks. The work was thus made much harder and considerable time was lost. The fixing of the high price of $105 per ounce for platinum by the U. S. Government during 1918 greatly stimulated the work, although the total production was not in relation to the greatly increased number of men engaged in the work.

The Condota River district is also a producer of platinum, but on account of the broken nature of the ground and heavy jungle no accurate estimate can be made of the possibilities of future production or of the extent of the platinum-bearing ground. Doubtless the fields are much smaller in extent than is generally supposed. In this region platinum predominates, there being approximately only 4% gold found with the platinum, while on the Quibdo side gold predominates, the platinum content of sands being only about 10%. Another part of the Quibdo district that produces platinum is the area near the headwaters of the Quito river, which is being worked now to a greater extent than ever before. Cartagena is the supply centre of the Quibdo region.

The labor engaging in this work is unsatisfactory. After working in the river a few weeks and making good pay, they will return down the river for the remainder of the season. Although as many as 300,000 men come into the platinum country during a single year, not more than 3000 men are working there at one time. The climate is very unhealthy. Several large companies have failed in attempts to use large modern dredges in this platinum and gold-placer district.

Mining property may be acquired by denouncement, as it is termed locally. A mining claim consists of an area of 240 by 1800 metres for quartz and vein mines, and 1000 by 5000 metres for placer claims. A quartz claim covers 106.75 acres and a placer claim covers 1235.5 acres. Assessment work does not have to be done, but an annual contribution or tax is paid on all claims held. This tax averages about $20 per claim for ground rent, and does not include the various taxes, such as those on production and export. Americans wishing to acquire mining land by denouncement in Colombia are obliged to have the location made for them by trusted Colombians and transfer made to them later, since the law does not prohibit native citizens from transferring mining property of foreigners if the permission of the Government is secured previously. During the period from 1910 to 1914 there were 3821 mining claims, chiefly gold mines, located in Colombia, and the Government granted 1018 titles to mines in all parts of the country. There are records of 18,386 mines in the country, but their exploitation is on a scale very inferior to their merits as mineral deposits.

In his annual report for 1918, the Minister of Public Works states that, although the total export of precious metals from the country reaches nearly $6,000,000 annually, the net product for the National Treasury is only $18,000, and it is recommended that mining contributions and taxes be increased and new legislation carried through to correct this condition. A presidential decree of July 9, 1918, prohibits the adjudication of placer or alluvial mines in the beds of navigable streams. A special permit from the Minister of Public Works is necessary in order to obtain permission to work placer ground in the bed of a navigable stream. An examination by government engineers has to be made in each case. In all legislation appertaining to mining there seems a decided tendency toward Government control.

The Choco district is also said to contain many other minerals, such as copper, lead, silver, and palladium, but little is known of the real extent or value of the veins or deposits. Many rich samples of all of these ores have been brought in by the native prospectors out for gold and platinum.

Foreign companies wishing to prospect for placer mining in Colombia should be prepared to furnish a large expedition, well equipped and having men experienced in the tropics. Medical service should also be provided as a necessary requisite to the success of the work. Such properties can only be developed successfully by large capital and the cost of operation and equipment is great. The general opinion among practical and experienced mining engineers who know the country and conditions, is that only the most valuable ground can be worked at a profit under present circumstances.

The United States took almost the entire platinum output of Colombia during the War. The following table shows the quantities imported from that country during 1915, 1916, and 1917. Statistics for 1918 show only the value of the platinum exported to the United States from Cartagena:

Fiscal year.	Ounces.	Value.
1915	13,601	$ 470,938
1916	25,588	1,473,553
1917	21,278	1,536,422
1918		1,325,481

THE output of platinum, palladium, and other metals of the platinum group in Alaska in 1918 is estimated at 284 fine ounces, valued at $36,600, according to the U. S. Geological Survey. From some districts the recovery was larger and from some smaller than last year. Some palladium and platinum was recovered from the copper ore of the Salt Chuck mine, near Ketchikan.

FROM OUR OWN CORRESPONDENTS IN THE FIELD

ARIZONA

PRACTICAL MINING COURSE AT THE COPPER QUEEN.—MAGMA COMPANY PURCHASES THE THREE R MINE.

DOUGLAS.—The transmission line between the Copper Queen smelter at Bisbee and the mines of the Phelps Dodge Corporation, Copper Queen branch, is nearing completion and it is hoped it will be ready for use by December 1. This line will supplement the central power plant of the Copper Queen at Bisbee in operation of mines and the new Sacramento mill. The Copper Queen smelter has been giving attention to fire prevention recently. A department of five companies, under direction of William Van Winkle, chief roundsman, has been organized and has a fire-drill every Saturday. Twice each month competitive drills are held, a box of cigars being furnished by the smelter management for the winning team. Alarm boxes have been made conspicuous by day by being mounted on red poles with white stripes, and at night a red lantern is attached to each box.

BISBEE.—Interesting meetings of the Copper Queen practical mining course are being held each Wednesday afternoon and evening at the Y. M. C. A. under the direction of S. O. Richardson. The class is making a thorough review of 42 papers read during the course, which covers all phases of mining operations. Following the review, examinations will be held for the benefit of all Copper Queen employees who attended 21 or more of the lectures. A new course is to be undertaken shortly after the first course has been completed, and further examinations will be held from time to time for those qualified to take them.

A new change-room for employees on Sacramento hill is under construction near the Holbrook shaft. A large part of the old Holbrook dump was excavated and removed in order to form a site for this building. All waste from the Holbrook now is being dumped into railroad cars and hauled to the regular Sacramento Hill dumps. When the new change-room has been completed the old Holbrook change-room, at present in use by men employed on Sacramento hill, will be torn down and the site used for a waste dump. Work on a new 'safety first' building near the Czar shaft is progressing rapidly, after delays due to non-arrival of material. This department of the company hitherto has been housed in a small concrete building on Sacramento hill. Not only is this not the safest location for such work, but expansion of the work under direction of William W. Gidley has caused it to outgrow its present quarters. Several large transformers have been erected at the central power-plant of the Copper Queen preparatory to meeting increased power demands in this district as well as changes in distribution. The present plant is loaded to capacity but arrangements are being made for distribution of additional power from Douglas, where generators utilizing waste heat will be used to deliver power over the steel-tower transmission line. A sub-station is being built at the new mill to deliver power to this plant and to the pumps at the Calumet and Cochise shaft for supplying water to the mill. At one time the Copper Queen maintained separate power-plants for each of its shafts, necessitating a separate crew of engineers, oilers, etc., but as overhead was high and efficiency low under this method, utilization of central power-plants has become the practice. During the last two years operations have become so widely scattered and demands for power have increased to such a degree that entire re-arrangement of the system was necessary. In addition to the power supply from Douglas it will be necessary soon to erect a new plant at Bisbee.

PATAGONIA.—Negotiations for the sale of the Three R mine by the Magma Copper Co. have been concluded, the final papers having been signed by W. C. Browning, general manager of the Magma company. R. R. Richardson was the owner. The consideration is not announced, but is said to have been considerable, including a substantial payment at the time of the transfer and a series of deferred payments to allow the purchaser to develop the mine. The Patagonia-Superior Copper Co. has been incorporated by the Magma interests for the purpose of handling the Three R purchase. Mr. Browning, who is to be the general manager, expects soon to start active work. Extensive diamond-drill exploration is intended to be carried out over the entire property. Although the value of the Three R property is undoubted, its recent history has been one in which litigation figured largely. Prior to last spring the Three R was operated by the Three R Mining & Milling Co., of which H. C. and H. M. Harrison were the principal owners. A 200-ton mill was erected. The mine reverting to Mr. Richardson, Albert Steinfeld of Tucson and other creditors of the company asked that a receiver be appointed for the defunct Three R Mining & Milling Co. F. E. Fishburn was named to act in that capacity by the superior court at Tucson. Mr. Richardson, claiming that improvements at the mine reverted to him under contract, brought suit in the su-

perior court at Tucson to determine ownership. Mr. Browning has made a proposition to Mr. Fishburn, receiver, to purchase the surface improvements for $20,000, the money to be placed in escrow subject to the outcome of the suit brought by Mr. Richardson. Hearing has been set by the court, the creditors being given an opportunity to object to consummation of the sale should they desire so to do. If the sale is approved by the court, as is anticipated, the new company would own all improvements and have a clear field for development. Prior to the time the Three R mine was bonded to the Harrison interests it was bonded to N. L. Amster of Boston, Massachusetts, for $500,000. Mr. Amster worked it for a period, extracting and shipping considerable ore, but released it in 1914 at the conclusion of litigation between Mr. Richardson and Ben Heney, resulting in victory for the former. The property is situated in the Patagonia mountains, 9 miles south of Patagonia and consists of 55 claims. The principal workings are the Collosus tunnel, Evening Star tunnel, and Collosus shaft. The underground workings are about one and a half miles in extent. As the milling operations of the Harrison interests were not successful, it is reported that flotation or a combination of flotation and gravity concentration will be used.

Phoenix.—George W. Long, of Phoenix, and S. R. Poss, of New York, have acquired the controlling interest in the stock held by S. J. Tribolet in the Kay mine in Yavapai county. The consideration is announced to have been $500,000. The sale had been pending for several months. With the closing of the sale it was announced that the Kay Copper Co. had started development work on its property, situated in what is known as the Kay copper belt. A new 1000-ft. working shaft has been started and a complete modern plant of electrically equipped machinery is to be erected. During the last year development work at the Kay mine has opened a large body of ore and it is known that more than $6,000,000 worth of ore has been blocked out. Diamond-drill operations have opened other bodies which will be explored later.

COLORADO

CRIPPLE CREEK AND LEADVILLE

Cripple Creek.—A. E. Carlton, president of the Golden Cycle Mining & Reduction Co., has announced that if the coal situation requires the mill will be shut-down temporarily and the 2000 tons of coal now consumed monthly at the plant will be diverted to the mines of the district. Ores would in such cases be stored underground until the situation is relieved. The shut-down of the mill, the only plant handling district ores, would work a hardship on the small operators and lessees dependent on ore settlements to meet the payroll and mine expenditures.

Active operations have been commenced by the Isabella Leasing company, recently incorporated to operate a lease on the property of the Isabella Mines Co., Bull Hill. Operations, which are in charge of David Mason, started from the 15th level of the Lee shaft at a depth of approximately 1275 ft., where a cross-cut is being driven south-west to cut under the Buena Vista ore-shoot that produced high-grade ore. The work planned will cut below this old stope 450 ft. October production made by four sets of lessees now operating on the Isabella estate approximated 500 tons of milling-grade ore. The Portland company has not yet started to drive to the vein on the 23rd level, and cannot do so until the situation is completed and a pump erected. The level is below the drainage tunnel and makes considerable water. Ore from the bottom level of the Trail mine, at a depth of 1500 ft., is reported to be averaging from $32 to $38 per ton.

Labor is still curtailing production and few properties are working with full shifts. Miners are returning, however, from the snowy districts of the State and the winter months are expected to show increase in the men available, if the coal strike does not tie up the gold-mining industry. The output of the district for October exceeded that of the preceding month by 2481 tons. The total shipment was 53,071 tons of an average grade of $11.54 and gross bullion value of $612,804. Ore was treated as follows: Golden Cycle mill, Colorado Springs, 25,000 tons, average grade $20 per ton, gross value $500,000; Portland G. M. Co.'s Independence mill, Victor, 27,321 tons, $2.07 per ton, $56,554; smelter at Pueblo, 750 tons, $75 per ton, $56,250. Total $612,804. The following dividends were paid: Golden Cycle company, $45,000; Portland company, $60,000; Vindicator Consolidated, $15,000; total $120,000. The Golden Cycle will pay the regular monthly dividend of three cents per share, a total of $45,000, on November 10.

Leadville.—D. J. O'Neill and associates, operating the Continental Chief property under bond and lease, are extending the tunnel into Mt. Sherman in a search for the lost Continental Chief orebody, that in the early '80s produced ore of a value exceeding $1,500,000. The tunnel is now in 1600 ft., and, as estimated by survey, is within one hundred feet of the point where the vein and ore should be found. Many narrow quartz streaks and seams have recently been cross-cut and these will later be prospected. H. Schraeder has leased the Griffin property on Mt. Kevin and the Colorado Power company has extended its power-line to the mine. Mr. Schraeder is already shipping a car a week of ore with silver content ranging from 20 to 70 oz. per ton, and with machine-drills in operation will materially increase production. Schraeder has sub-leased the lower tunnel to Lucian Smith, who will also soon commence production. The coal situation in the Leadville district is serious, and with a prolonged strike all mines except those electrically equipped must soon close down. The Colorado Power company has its winter's supply on hand, or close to the tonnage required, but will have difficulty in meeting the many demands for power. At present it looks as if the strike would be short-lived, so that it is improbable that the district will have to face the serious situation that would result from the shut-down of many of the mines.

MICHIGAN

MINERS RETURNING TO WORK.—NEW COMMUNITY PARK AT CALUMET.

HOUGHTON.—Calumet & Hecla had 50 miners return from Detroit and 20 return from Flint last week, resuming underground contract work. They had been gone four months, working in automobile factories. They have no complaint to make regarding the work they are leaving, but frankly were homesick for the mine. They received higher wages in Detroit and Flint, but wanted their comfortable homes. They were all family men.

12½-TON SKIP, NO. 1 SHAFT, RAY CON. COPPER CO., RAY, ARIZONA

The company is working 80 drills in the shaft pillars and arches on the old Calumet conglomerate lode. Over half a million tons of high-grade ore has been taken from these pillars in the old mine. The conglomerate continues to average 14 ft. in mineral width. Osceola Consolidated has 200 men working at the old Osceola mine.

October boat shipments of copper from ports of the Michigan district were 14,406,000 lb., compared with 5,916,000 lb. in September and 9,618,000 lb. in October 1918.

The Federal Bureau of Mines has designated the Michigan College of Mines as headquarters for the district engineer and his staff and equipment for the entire Lake Superior mining district, which includes Michigan, Wisconsin, and Minnesota. Bryon O. Pickard, the district engineer, actually has made the college his headquarters for the past two years and the rescue car and the force of experts were assigned to the college to assist in instructing the soldier-miners, but Ironwood continued, nominally, to be headquarters until now.

La Salle Copper Co., a subsidiary of the Calumet & Hecla, is now employing but 20 men and is producing 1000 tons per month from development. The possibilities for the future depend upon the openings to the extreme north, near the boundary of the old Osceola branch of the Osceola Consolidated, where some good ground is in sight.

Seneca has concluded the purchase of the Gratiot, a Calumet & Hecla subsidiary, and will commence operations on the most southerly of the two Gratiot shafts immediately. The Gratiot carries the Kearsarge lode. It was opened ten years ago by the Calumet & Hecla, one shaft going down 1500 ft. and the other 1300 ft. The copper ore which was mined averaged 11 lb. in the mill-test. Seneca shaft continues sinking.

The Quincy Mining Co., which has operated its property on the hill outside the city of Hancock since 1848, has announced that its Community Center building, fully equipped with reading rooms, baths, gymnasium, auditorium, etc., for the use of its employees and their families, hereafter will be open to the people irrespective of whether they are company employees or not. This means that the Quincy mine club-house will be a public institution, a change that shows a rare concern for the good-will of the people generally. The Calumet & Hecla corporation has completed plans for an elaborate community park in Calumet, thus continuing its traditional policy of caring for the welfare of its employees. Calumet has everything in the way of community service that could be thought of, from the largest ice-skating rink in the world to the best band in the State. Now the company's big municipal park is to be situated in the vacant land that separates the village of Red Jacket from the mine location, a considerable acreage that has been kept clear of houses as a matter of fire protection. The Copper Range company operating the Champion, Trimountain, and Baltic mines, on the south range, now is figuring on a large community centre home to serve the people of all their mines and the village of South Range, contiguous to Trimountain.

NEVADA

FINANCING OF THE GOLDFIELD DEVELOPMENT CO.—LABOR AGREEMENT AT TONOPAH AND DIVIDE.

GOLDFIELD.—In a statement issued by A. I. D'Arcy, vice-president and general manager of the Development company, it is announced that as a result of his recent visit to New York the company "has arranged the necessary financing which will permit the carrying out of the full program as outlined". A meeting of stockholders is

to be called to increase the capitalization from 2,500,000 to 4,000,000 shares and the promoters of the company claim they have sufficient proxies to assure this. The report states that $27,000 has been spent in repairing the mill and that $205,000 more will be necessary to enlarge it to 2000 tons daily capacity and change the method of treatment to simple cyanidation. Mr. D'Arcy says 2,300,000 shares of stock has been issued and that the cost of mine development and mill repair has been $100,000. In speaking of future operations, the statement says: "On a basis of $5.50 ore, a $4 cost would leave a profit of $1.50 per ton, or a net profit of $2,225,000 on a minimum tonnage of 1,500,000." The total cost for mining and milling is estimated at a minimum of $3.15 per ton, the items in the estimate comparing as follows with the $5.17 figure of the Consolidated:

	Goldfield Consolidated	Goldfield Development
Mining	$2.72	$0.71
Transportation	0.06	0.10
Milling	1.53	1.61
Concentrate treatment	0.34	...
Marketing bullion	0.03	0.03
Marketing by-products	0.01	...
General expense	0.34	0.25
Bullion tax	0.03	0.03
Moving dumps	0.01	...
Moving tailing-dumps	0.01	...
Property tax	0.03	0.03
Filter royalty	0.04	0.04
Flotation royalty	0.02	...
Royalty to Consolidated	...	0.35
Total cost	$5.17	$3.15

In closing his statement, Mr. D'Arcy says: "While I cannot make a positive assertion that the lease will be renewed for another period of five years, at the time the Goldfield Development Co. obtained the lease it was given the verbal assurance of the Consolidated management that the lease would be renewed if the Development company carried out its program in a vigorous way."

Assays from controls put a value of $120, $66, and $41 per ton respectively on the 22nd, 23rd, and 24th cars shipped by the Florence Divide lease on the Florence. The main stope, started from the 400-ft. level of the Red Hill shaft, is now 62 ft. high and 50 ft. long. The vein has an average width of from 18 to 20 ft. and the main production is being made from the hanging-wall side, where the value is practically all in gold as distinct from the foot-wall, where the ore assays high in copper. The ore-shoot has been opened for a length of 120 ft. and the lease superintendent states that the limit has not been found in any direction. Except for a 45-ton carload worth $26 per ton, shipped from the Doleic lease in the old Wheeler block, no ore has been produced by other lessees for a long period. Ore assaying $9 to $30 has been opened for a distance of 120 ft. on the dip of the vein in the Cracker Jack, which is regarded as the most important development in Goldfield in recent years because of the situation of the Cracker Jack outside the proved zone. The ore is in the Columbia mountain fault, the hanging wall of the vein being andesite and the foot-wall rhyolite.

Simon District.—The Norman Silver, in which P. A. Simon, president of the Simon Silver-Lead Co., recently bought a controlling interest, has been consolidated with the Fagan, adjoining on the north-east, and a new company, the Fagan Consolidated Silver Mines Co., has been formed to develop both groups of claims. Simon is president of the Fagan Consolidated. The Norman and Fagan groups, a total of 12 claims, are 1½ miles south-east of the Simon Silver-Lead. A large amount of prospecting has been done in the Fagan, principally through a 45-ft. shaft in which high-grade ore is exposed. The main shaft of the Norman is 85 ft. deep. The cross-cut from the shaft on the 300-ft. level has been driven nearly 100 ft. beyond the rhyolite intrusion formerly supposed to be the hanging wall of the vein, and the face is still in sulphide ore of good grade. The extension of this cross-cut has exposed orebodies on each side of the rhyolite for a total width of nearly 150 ft., with good ore extending into the rhyolite.

Round Mountain.—The Gibraltar, a promising silver-gold prospect in Jett canyon, Smoky valley, has been financed by Eastern interests and it is reported that development work on a large scale is to be undertaken. Assays of from $25 to $160 have been obtained for a distance of 300 ft. on the vein outcrop, it is said. Harry Stimler, discoverer of Goldfield, took an option on the Gibraltar last summer.

West Divide.—Work in the north drift from the bottom of the 60-ft. shaft of the West Divide has been discontinued. The face assayed $75 when work was stopped. The south drift has been driven 25 ft., and 18 in. of ore assaying from $65 to $95 is exposed across the bottom. This will be continued 125 ft. to cut under a point where good assays have been obtained on the surface. An old tunnel south of the shaft is being repaired and will be continued to cut the vein at a depth of 150 ft. Attempts are being made to finance two other companies owning claims in the district.

Tonopah.—The Tonopah and Divide miners have accepted a proposition of the operators providing for an immediate increase in wages of 50c. per day and a commissary to handle meats, groceries, wood, coal, and miners' clothing. This agreement is to remain in force until a Federal mediator decides that the commissary has resulted in a reduction in the cost of living amounting to 50c. per day. The mediator is to return at the end of 60 days to decide on this, and will continue to return thereafter every 30 days until he decides the 50-cent daily saving is being accomplished. The bonus will then be withdrawn. The operators believe that by next August there will be a general lowering of wages in all industries throughout the country and they do not anticipate further trouble when the cut is made. The 50-cent wage increase is retroactive to the time the men returned to work.

The agreement came after weeks of effort in which the operators' meetings were controlled by the Tonopah Min-

ing, Belmont, and Tonopah Extension companies of Tonopah, with 800 votes against 600 of the Divide operators, based on the number of men employed in July. The crisis was passed when the Tonopah operators were brought into line by a threat of the Divide owners to withdraw and form a separate association. This followed a meeting that was adjourned without debate after a wage increase had been voted down. Although labor conditions have improved considerably there still is a serious shortage of skilled miners in both districts.

Bishop.—The Tungsten Mines Co., operating 8 miles west of Bishop, suspended operations on September 20. It is expected work will be resumed in the spring. To May 1 the company employed from 90 to 100 men, but on that date, a contract at $30 per unit expiring, the force was cut to 55. From the date of the expiration of the contract to September 20 two hundred and thirty-eight tons of concentrate was produced and stored. The concentrator, said to be largest in the world treating tungsten ore, has a capacity of 500 tons daily. The deposits are low-grade.

Photo by Tune, Goldfield

SURFACE PLANT OF THE FLORENCE MINE, GOLDFIELD, NEVADA

OREGON

POSSIBLE EXTENSION OF THE MEDFORD-JACKSONVILLE RAILWAY. GEOLOGY OF THE BLUE LEDGE MINE.

Gold Hill.—The purchase of the Medford-Jacksonville railway by the Gagnon Lumber Co., of Medford, Oregon, is a matter of importance to the development of the copper deposits in the Blue Ledge district in the southern part of this county and northern California. The lumber company has a large holding of saw-mills and box-factories in Medford and Jacksonville, and this road already extends into the timber of the Applegate district supplying these plants. The new owners have already taken steps to organize a company to extend the railway from Jacksonville a distance of 35 miles to the Blue Ledge mine, California, and from there on to the coast at Crescent City. During the War this region was a heavy shipper of high-grade copper ore to the Puget Sound smelters. During that time the smelters found these ores essential in fluxing with the Alaskan ores from the north, and the result is that they are now in the market for all the available ores from this region.

This has been an impetus for the Blue Ledge mine to continue operations since the War under the high cost of mining. The mine is operated with 40 miners and has a weekly output of three cars of ore. It is under lease to the Mexican S. & R. Co., of New York. Jerome A. Hilbert is engineer in charge at Copper, California. Only ore running 12% or more is shipped, while the lower grades are being dumped to await future reduction at the mine or a lower shipping rate to the smelters. The present wagon haul to the shipping-point at Jacksonville from the mine costs $11 per ton, which is done by wagons the first six miles from the mine and thence by 5-ton capacity auto-trucks.

The ore of the Blue Ledge mine consists of nearly solid pyrite and chalcopyrite with a little pyrrhotite and sphalerite or galena. The deposit is opened by a series of adits on the face of a cliff at different elevations; with the winzes and raises this gives a vertical exposure of ore for about 800 ft., and a horizontal exposure for about 2000 ft. The elevation of the mine is 4000 ft. The first fissures were cemented by coarse vein quartz; after shearing the second fissures were filled with calcite, chlorite, and sulphides. The veins average 2 ft. in thickness, and are narrower and lower grade in the lower levels. The veins strike nearly due north and dip about 65 degrees west; they are parallel with the banding of the schist country-rock, but locally cut across it. There are three

veins which are roughly lenticular in form; one lens succeeds another along the strike, usually with a small offset. The hanging wall is a soft white schist near the vein, but elsewhere it is a mineralized quartzite containing some muscovite. The foot-wall is a bluish-black hornblende schist. The position of the bedding and rock cleavage seems to indicate that the mine is on the east side of an anticline (overturned to the east) which pitches to the south. Faults are common in the workings but usually the offset is only 1 to 5 ft., so that there is no difficulty in following the veins. Pyrite in big cubes occurs in the wall rocks, especially in the hanging walls.

UTAH

LITIGATION BETWEEN UTAH-APEX AND UTAH CONSOLIDATED. —SHORTAGE OF CARS IN THE EUREKA DISTRICT.

SALT LAKE CITY.—Contrary to expectations, there was no strike of the coal miners of the State on November 1. On the afternoon of October 31, John McLennan, international representative of the United Mine Workers, who had been in Carbon county directing the organization of miners, made the statement that there would be no 'official' strike of the unionized miners. Nevertheless, Government and State officials took measures to prevent any possible disturbances or damage to property at the coal mines. A detachment of 100 soldiers of the Twenty-first infantry at Fort Douglas, Utah, was sent to Helper, in the heart of the coal district, on October 31, and five officers and 110 men of the Thirty-second infantry at Camp Kearney, California, were also sent to Helper. All the mines were short of men on November 1, but this was due largely to that day being a religious festival—All Saints' Day—which was a holiday with the Italian and Austrian miners. On November 2 announcement was made that coal from Utah mines would be held at convenient points along the various railroads of the State by officials of the roads, acting under orders from the United States Railroad Administration. It is expected that the output this year from Utah coal mines will be about 5,000,000 tons.

Trial of apex litigation involving hundreds of thousands of dollars, between the Utah-Apex Mining Co. and the Utah Consolidated Mining Co., operating properties in Bingham, began November 3 in the United States District Court before Judge Tillman D. Johnson. Nearly a year's time has been used in preparation of the suits, of which six have been filed between the two companies. The present suit, it is expected, will continue about three weeks. The litigation is based on apex rights to large orebodies which have been, and are being, mined by the two companies in the Highland Boy and Yampa veins of the West Mountain mining district. The litigants are among the largest of the Bingham operators and for years have been extracting large tonnages of silver, lead, and copper ores. The Utah Consolidated has been one of the leading copper and lead producers in the State, and has a dividend record of over $14,000,000. The property was opened up a number of years ago by Samuel Newhouse, originally as a gold and silver mine. It later developed into a large copper producer, and at the time R. H. Channing, now president and managing director, was put in charge of the work, he was able to produce copper at 6c. per pound, a cost lower than any other mine in the State has obtained, and at the time the record for the United States. The property later changed hands, going to Standard Oil interests for $6,400,000. Since then it has more than paid this back in dividends. The company ships its ore by tramway over the Oquirrh range to the International Smelter at Pine Canyon, above Tooele. At present it is producing about 125 tons of ore per day. The Utah Apex is the largest lead mine in the State. Development work during the past summer has been highly gratifying, and there is more ore developed today than ever before. The mine is capable of marketing 1000 tons of silver-lead ore per day, but owing to shortage of labor is producing about 300 tons. It is estimated that the cost of the suit will be $500,000, about equally divided between the two companies, according to intimation given by attorneys on both sides.

ALTA.—The unwatering of the Emma Silver mine has been entirely successful. The bottom of the winze at the 300-ft. level is now accessible. Development work is being actively pushed.

After a tie-up of two weeks on account of heavy snowstorms, the Cardiff Mining Co. resumed shipments on October 31. Ezra Thompson, the manager, states that conditions at the mine are encouraging and that recently a large body of ore was opened on the 800-ft. level, averaging $50 per ton in silver and lead.

Satisfactory progress is being made at the Howell mine, according to T. L. Walden, general manager. Operations in the main drift, which is being driven to tap the old workings, are proceeding steadily. The new electrical equipment erected during the summer is working smoothly, and sufficient supplies necessary to carry on operations during the winter have been put in.

A shortage of cars and recent snowstorms are responsible for the decrease in number of carloads of ore shipped during the week ending October 31. Of the 102 cars shipped, Dragon Consolidated leads the list, with Chief Consolidated a close second. Shipments from the Tintic Standard dropped to 4 cars, owing to inability to secure additional empties.

The E. J. Longyear Co. has taken over the East Tintic drilling operations of the Chief Consolidated Co. and will keep the machines running throughout the winter months, the work being under the supervision of R. D. Longyear.

On account of the increased activity among the mining properties of the East Tintic mining district, it has become necessary for the Utah Power & Light Co. to provide a 'tie-line' between the Tintic Standard and Copper Leaf mines. Work will be completed about December 1, and thereafter all mines in that vicinity will have ample power.

The Goshen Valley railway, a spur line from the Denver & Rio Grande railroad at Pearl, Utah, to the Tintic Standard and Iron King mines, has been completed and put in operation as far as Flora. The completion of the

road to Flora will facilitate the shipping of ores from the East Tintic district. Ores from the Tintic Standard heretofore have been hauled five miles by truck, whereas the distance to Flora is one and a half miles. The road will be completed to the Tintic Standard mine about January 1.

Plans for the consolidation of three large mining properties in the East Tintic district are being completed, according to F. C. Richmond of Salt Lake City. The mines involved are the South Lily, the Montana, and the Bonanza. This consolidation will give the newly organized company a total of 600 acres, adjoining the Tintic Standard, in what is considered a promising field. Surface indications and geological conditions have convinced those interested that the extension of the Tintic Standard vein will be found in the company's property. A shaft 550 ft. deep has been sunk. When operations are resumed by the new company, this shaft, at present a two-compartment—a manway and a working way—will be made a three-compartment shaft. The timbering will be renewed and equipment installed to sink to a depth of 1400 or 1500 ft. before cross-cutting to the objective, the Tintic Standard vein.

PARK CITY.—From nine to ten feet is being made per day in the driving of the Spiro tunnel in the Silver King Consolidated mine. The formation, a gray lime, is softening; work is being done without interference from water, and the strata, which were lying at an angle of 15° from the horizontal, are straightening up and are standing at present at an angle of 30°. Shipments from the new deposit recently struck in the Electric Light claim are proceeding as rapidly as cars for shipment can be secured.

Shipment of ore for the week ending October 31 amounted to 1447 tons. Of this tonnage, Silver King Coalition shipped 527; Ontario Silver, 395; Judge M. & S., 195; Daly West, 385; Daly Mining, 54; and Naildriver and Silver King Consolidated each 55 tons.

The Ophir Silver Mines Co. has filed articles of incorporation with the Secretary of State. The company owns the Economy group of 15 claims in Tooele county, and is said to have a well defined vein, which has been prospected to some extent, several samples returning high assays. It is understood that the company will equip the property with suitable machinery for an extensive development campaign, which is expected to begin early in the new year.

DUGWAY.—Organization of the Buckhorn Silver Mining Co., to operate the Buckhorn mine, was accomplished recently. This mine is situated fifty miles west of Faust station on the Salt Lake route, the nearest rail point. From its discovery on March 11, 1891, to July 1 of that year, $83,000 was received from ore shipments, when the ore-shoot was lost and the property abandoned. The ore shipped was principally a chloride containing much horn-silver and free gold, and assayed at the smelter from $200 to $1100 per ton in shipment lots. That the ore-shoot can be picked up again is considered reasonably certain.

WISCONSIN

REVIEW OF OCTOBER OPERATIONS IN ZINC LEAD DISTRICTS.

Standard commercial zinc ore opened the first week in October, on offerings of $43.50 per ton, base 60% zinc assays, with second-grades at $42.50. Top grades were advanced the second week to a base given out for publication at $46 to $47 per ton, second-grades unquoted. The upward movement in price was continued in the third week, offerings going to $48.50 per ton, base, with fancy or top-grade blende well in advance of $50 per ton. The last week of the month gave evidence of higher price levels, offerings being advanced to $51. With the last advance came an unmistakable demand for all grades of zinc ore, in which even the low-grade producers shared liberally, although the price on this was a little in advance of 60c. per unit of zinc in the ore. Following closely upon these better prices came increased exploration and development, two score or more drilling squads being at work at various points in the field. New mine development was undertaken, principally in the southern districts. Several new operating concerns started, with initial shipments of both zinc ore and lead ore, and some new power, mining, and milling plants were planned.

Similar gains occurred in the lead-ore market. Breaks on offerings were sharp and marked, the base, at the beginning of the month held in advance of $70 per ton, giving way to offerings of $85 per ton before the close of the month. Sellers were little disposed to come into the clear and part with their holdings, and shipments were therefore comparatively light, but in the aggregate the turn-in for the month was heavier than for any one month so far this year. Production showed considerable gain, due mainly to extensive deposits of lead ore recently uncovered at new producing mines. The reserve in the field was left untouched and at some points output of both zinc ore and lead ore exceeded bin capacity and the milled ore was dumped on the ground.

Shipments of pyrite from refining plants in the field were comparatively light all month. A gain in the total net deliveries was shown however by the introduction of heavy deliveries made from the Mineral Point Zinc Co. to Grasselli Chemical Co. of residue obtained in the ordinary course of zinc-ore separation.

Deliveries of zinc ore, lead ore, and pyrite, from mills to local refineries, and some ore from mines of good grade to smelters direct, were made for October as follows:

Districts	Zinc, lb.	Lead, lb.	Pyrite, lb.
Benton	13,704,000	478,000	2,396,000
Galena	5,968,000	348,000	.....
Livingston	5,076,000	.....	.....
Hazel Green	2,216,000	1,120,000	.....
Cuba City	1,924,000	472,000	1,036,000
Highland	1,800,000	80,000	.....
Shullsburg	274,000	.....	.....
Platteville	88,000	.....	.....
Linden	.....	38,000	.....
Mineral Point	.....	.....	5,000,000
Total	31,050,000	2,536,000	8,432,000

Deliveries of the high-grade blende from reduction plants in the field to smelters, were as follows:

	Lb.
Mineral Point Zinc Co.	6,014,000
Wisconsin Zinc Co.	5,764,000
National Ore Separating Co.	3,470,000
Linden Zinc Concentrating Co.	862,000
Block-House Mining Co.	88,000
Total	16,198,000

The gross recovery at mills for the month aggregated 15,029 short tons; net deliveries from both refining plants and from mines to smelters direct, 10,821 tons.

Of the raw ore recovered distribution was made locally to the Mineral Point Zinc Co. 6606 tons; Wisconsin Zinc Co. 2821 tons; National Zinc Ore separators 3383 tons; Linden Zinc Co. 930 tons; on high-grade from mines and refiners to Grasselli Chemical Co. 4369 tons; American Zinc Co. 1457 tons; United Smelters 853 tons; American Metal Co. 235 tons; Mineral Point Zinc Co. 3007 tons. About 900 tons high-grade ore was held in bin at the close of the month and all other grades, about 5500 tons.

BRITISH COLUMBIA

TROUBLE IN THE COAL INDUSTRY NOT EXPECTED.—TRAIL SMELTER TO TREAT ZINC CONCENTRATES.

The present prospects are that the bituminous mines of British Columbia will not be affected by the strike in the United States. All the collieries of Vancouver island, as well as those of the mainland, are working as usual and there are no reports of impending trouble. The same applies, to date, to the mines of the province of Alberta. It was reported that the State of Washington would look to British Columbia to replenish its empty coal bins, the assertion being made that 10,000 additional tons would be shipped to the Sound every month in order to assist in overcoming any shortage that might develop. This caused some uneasiness in this Province, it being felt that it might result in industrial and domestic embarrassment at home. J. M. Savage, manager for the Canadian Collieries (D) Ltd., has stated that his company would make no greater shipments to the United States than usual for the simple reason that it was not in a position to do so. He said that the local demands were so heavy that the company was fully occupied taking care of them. Certainly the local market would have to be cared for before export was considered. Much the same statement was made by W. A. Webb, of the Canadian Western Fuel Co., which operates the Nanaimo Collieries, who added that the State of Washington could not look for more coal than now was being sent out because it was outside the capacity of the company to make such deliveries. Consequently those who were inclined to dispute a policy of permitting export of coal at the present moment apparently have been silenced. The bunkering of steamships sailing from Puget Sound ports will not be affected. Most of these vessels call at Nanaimo for their fuel. The Nippon Yusen Kaisha and Osaka Shosen Kaisha vessels will be able to obtain coal from Sound bunkers which are filled from Vancouver Island mines.

SLOCAN.—An important discovery is reported on the property of the Rambler-Cariboo Mining Co. The new body of ore was found in the 900-ft. drift on the Jennie ground, the Jennie and Last Chance claims having been acquired by the company last summer. The Rambler is one of the largest operators as well as one of the oldest producers of the district, its output for the past 25 years having reached probably $2,000,000 of which $550,000 was paid out in dividends. Developed on a comprehensive scale, with a 1400-ft. shaft and a big cross-cut through which all the ore was brought out for years, the Rambler has been one of the best examples of drift development in the Kootenay. Active stoping now is proceeding on the 1000, 1200, and 1300-ft. levels, from which 30 tons of ore on the average is produced for the concentrator, which occupies an exceptionally favorable location on the middle fork of Carpenter creek. The mine and mill are connected by 1500 ft. of aerial tram.

TRAIL.—In order to keep its electrolytic zinc plant at Trail in operation during the inactivity of the Sullivan Mines at Kimberley, the latter being shut-down through a strike of the miners for an all round increase in wages of $1 per day, the Consolidated Mining & Smelting Co. has arranged to treat the accumulated zinc concentrates of various Slocan district properties. The Rambler-Cariboo has 500 tons of concentrate, the shipment of which has commenced. The Standard, at Silverton, also has begun shipment of zinc concentrate, of which it is said to have some 300 tons. The Echo, at Silverton, is expected to contribute about 350 tons. A large quantity of zinc concentrate has been accumulated by the Rosebery-Surprise Mining Co. but it has not accepted the smelting company's terms up to the present. The settlement price is 2c. per lb. for the zinc, 75% of the zinc content being paid for when the concentrates run 50% zinc and 1½% being deducted for every unit the material is under 50%. The settlement for silver is the New York price on the day of sampling, 50% of the silver content being paid for, this rising to 60% if the silver content is 30 oz. or over per ton.

STEWART.—The statement that the Guggenheims had purchased a 51% interest in the Premier mine for $5,000,000 was wired to Stewart from New York, where Messrs. Wood and Trites, two of the principal owners, were known to be, and was accepted in good faith and reported accordingly. It is now learned that only a two-fifths interest has been purchased. The owners refuse to divulge the consideration, but it is common rumor that the price paid was on a basis of $5,000,000 for the mine, or $2,000,000 for the two-fifths interest. The following are the officers of the new company: R. W. N. Wood, Fernie, B. C., president; H. A. Guess, representing the Guggenheim interests, first vice-president; Minor Keith, New York, second vice-president; R. W. N. Wood and W. R. Wilson, Fernie; R. K. Neill, Spokane; and H. B. Price, W. C. Potter, and H. A. Guess, New York, directors. R. K. Neill is manager; W. E. Norris, secretary;

and L. A. Chaplin, treasurer. During the coming winter, the company will use several specially designed tractors for drawing the ore from the mine to tide water.

ONTARIO

GENERAL NEWS OF THE PROVINCE.

COBALT.—Silver production from the mines of Cobalt is averaging about 35,000 oz. daily. Every producing mine is working at normal capacity, and ample men are available. The system of appointing individual committees composed of employees at each mine is being carried out successfully. This was the basis on which the men by the Hollinger Mines that the company has succeeded in reducing the cost of living 15% during the past 67 days. Company employees are sold commodities at cost. Some hope is entertained that the mechanical shovelers now being tried in the leading mines may in a measure at least overcome the present shortage of unskilled labor, such as shovelers. The Dome Mines is treating a little over three tons of ore daily for each man on its payroll. Compared with this, the Hollinger and the McIntyre are treating between one and a half and two tons per man, the smaller stopes not allowing the ore to be broken to such advantage.

KIRKLAND LAKE.—The Tough-Oakes has announced

A BLAST OF 25 TONS OF 40% POWDER, MOTHER LODE MINE, GREENWOOD, B. C.

returned to work following the labor strike which ended September 7.

The Coniagas ended its fiscal year on October 31, having produced over three-quarters of a million ounces of silver during the period. The annual statement will not be prepared for from one to two months, but it is learned officially that ore-reserves are such as to assure from two to three years' production, based on current quotations for silver and the present rate of output. High-grade ore has been encountered on the Silver Cliff mine. That part of the property lying between surface and a depth of 500 ft. is under lease to the Northern Customs Co. The ore-shoot is said to be limited in extent. The Temiskaming Mining Co. is reported to be negotiating for the purchase of the Buffalo mine. The officials of the Buffalo decline to make a statement regarding the report. The Trethewey-Cobalt Co. will hold a meeting November 7 for the purpose of considering the advisability of acquiring two more silver prospects in the Gowganda district. The question of taking over the remaining 49% of the stock in the Castle company is also being considered.

PORCUPINE.—An official announcement has been made that it will not resume operations until next March. The reason given is that the difficulty of securing men and the cost of heating, together with the scarcity of coal, makes it advisable from an economic standpoint to not attempt a resumption of work at this time.

The other mines that were producing before the strike are all in operation again.

The three large producing mines, the Lake Shore, Teck-Hughes, and Kirkland Lake, have now all the men they require. The Kirkland Lake mill is running to capacity treating about 150 tons of ore daily. A vein of rich ore 15 ft. wide is being developed on the 600-ft. level. The shaft will be put down from the 600 to the 700-ft. level.

BOSTON CREEK.—The Miller Independence will construct a first-class road from Boston Creek station to the mine, which will enable the company to haul in heavy milling equipment this winter. The new central shaft is now down 255 ft. A station will be cut at 400 ft. and the shaft continued to the 500-ft. level. At the Boston-McCrea 18 men are at work with a small steam-plant. The surface outcrops have been sampled and test-pits sunk, and the results having been satisfactory a shaft is being sunk and is now down 40 feet.

QUEBEC

HARRICANA RIVER.—The British Minerals Corporation will undertake an exploration campaign on the Sullivan and Siscoe properties in this district, near the Ontario boundary. The Sullivan claims are situated on the shore of Lake De Montigny and the first discovery of gold in the district was made on this location in 1911. Some ten mineralized veins occur on the Sullivan group. The Siscoe is situated on an island comprising about 360 acres, where gold occurs in veins and stringers containing considerable tourmaline and some disseminated pyrite.

SONORA

YAQUI RAIDS IN THE MOCTEZUMA DISTRICT.—ARBITRATION BOARD FOR SONORA.

AGUA PRIETA.—The presence of a large band of Yaqui Indians in the Moctezuma district during the last week in October and the early part of November disorganized mining conditions, particularly in the outlying properties. Hundreds of miners and their families sought safety in the large towns during the raid, while threats on the part of the Indians to enter Pilares and Nacozari kept the people keyed up to a high pitch and decreased efficiency. The Indians were disastrously defeated at Bacadehuichi by a Federal force under Lieut.-Col. Gilberto Limon, November 1, and on the following day again were defeated in a skirmish a few miles south of Bacadehuichi. They were reported to have lost a total of 11 killed, as well as all their horses and the loot they had gathered in their raid through the eastern part of the Ures district and the southern and eastern parts of the Sahuaripa district. General Juan Torres, military commander of the State, at the head of a force of six hundred men, went south from Agua Prieta November 3 to sweep the north-eastern part of the State clean of the Indians. General Torres said he had a total of 4500 men under his command and intended to push so vigorous a campaign that mining men would be able to work their properties, no matter in what part of Sonora they might be situated.

Ore shipments from Sonora during October exceeded in value those of a number of months, according to a report from the office of J. M. A. Tostado, collector of customs. El Tigre not only exceeded its recent record, but the record of the property as a whole by shipping 21 carloads of concentrates to the El Paso smelter. The total estimated value of ore exported at this port was $2,230,000, Mexican gold. The total amount was 251 cars, or 11,175 tons. The shipping properties and amount sent out by each were: Nacozari 9890 tons; El Tigre 940 tons; Estrella 80 tons; Prieta and Coronel 40 tons; Promontorio 40 tons; Monte Cristo, La Escuadra, and San Jose 45 tons; La Caridad 40 tons; San Pedro and San Pablo 50 tons; San Nicolas 50 tons.

PROMONTORIO.—This property, owned by the Phelps Dodge interests, again has entered the lists as a shipper, the ore being freighted through Moctezuma to Nacozari to Douglas for treatment. It is a high-grade copper ore. A few men have been put to work on the dumps sacking ore for shipment. When this has been completed, a larger force will be added. News of re-opening the Promontorio was gladly received around Moctezuma, where freighters have been experiencing a lack of work, due to mining conditions in the south end of the district.

CANARIO.—James P. Harvey, president and managing director of this property, has returned from New York, where he recently attended a meeting of stockholders. It was decided at this meeting to increase the capitalization of the company from $2,000,000 to $20,000,000. This was done by re-incorporating the New York corporation under the laws of Delaware and increasing the value of the two million shares from $1 each to $10 par. The Canario has been developing its properties a few miles north-west of Nacozari for the last two years and has considerable bodies of low-grade copper ore blocked out. Some of the stockholders wished to push development faster and enter the producing field, but Mr. Harvey counselled against this move until sufficient ore had been blocked out to warrant the erection of a large concentration plant. His policy finally was adopted by the company. Most of the stockholders are eastern people, although there are a few in Arizona, among them being Col. B. A. Packard, president of the First National bank of Douglas, who is a director.

CANANEA.—A temporary shortage of desirable labor has been felt here recently as a result of the exodus to the Arizona farm districts of many laborers who ordinarily work in the mines, mills, or smelters. Drawn by promises of large wages and good conditions to the Salt River valley to pick the cotton crop, many of the steadiest men in this district went to Arizona about a month ago. However, as the cotton crop is almost cleaned up, some of these men are already returning. No change in mining conditions is visible in the district at present, the Cananea company working about the same number of men and showing no indication of further increasing its mine or smelter output. The Democrata smelter continues to operate at about half its normal capacity. A meeting of delegates from the various mining companies in northern Sonora was held here October 16 for the purpose of selecting representatives of the laborers and companies for the northern zone of Sonora on the board of conciliation and arbitration proposed by Governor Adolfo de la Huerta. Ezequiel L. Rivas was selected by the miners as their representative. The companies, represented by Charles L. Montague and George Young for the Four C., Ramon Estrada for the Democrata, C. Sevillo for the Catalina, and Carlos Martinez for El Tigre, conferred upon the appointment of a man but made no announcement. It is expected that the announcement of their selection will be made early in November. Governor de la Huerta proposes to have the board formed of one representative each for capital and labor in the northern, central, and southern districts of the State, the governor himself to name a seventh member. All disputes as to wages, working conditions, and other questions affecting relations between employers and employees in the State are to be brought before this board for arbitration.

SUSPENSION OF ASSESSMENT WORK

H. J. R. 241, suspending assessment work on all mining claims for 1919, was passed by the Senate on November 5 and has gone to the President for signature. This will be welcome news to the mining industry, as there seems to be no doubt that the President will approve the Act and relieve the confused conditions resulting from the passage of the Act of August 15. The effect of the new Act is to do away with the 5-claim limitation of previous legislation.

The text of H. J. R. 241 follows:

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the provision of section 2324 of the Revised Statutes of the United States, which requires on each mining claim located and until a patent has been issued therefor, not less than $100 worth of labor to be performed, or improvements aggregating such amount to be made each year, be, and the same is hereby, suspended as to all mining claims in the United States, including Alaska, during the calendar year 1919;

Provided, That every claimant of any such mining claim in order to obtain the benefits of this resolution shall file or cause to be filed in the office where the location notice or certificate is recorded, on or before December 31, 1919, a notice of his desire to hold said mining claim under this resolution.

These notices will be available for distribution at the State Mining Bureau, San Francisco, as soon as the law becomes effective.

ARIZONA

The Yellowbird Mining Co. has been taken over by the Silverita Mining Co. This company's property was purchased from S. W. Purcell of Tucson and is situated in the Papago district in the Sierrita mountains. The company is shipping regularly, the average of the shipments exceeding $250 per ton in copper and silver.

Five thousand dollars was paid by the Daily Arizona Consolidated Copper Co. to Pinal county to complete the construction of a road from the Daily camp to the Three C ranch.

A new big discovery of ore has been made on the 100-ft. level of the El Tiro mine at Silverbell, which is under bond and lease to Percy Williams. The vein has been opened for 22 ft. in width assaying, it is said, 8% in copper. The ore is carbonate. Eight cars of 7% copper ore are being shipped each week.

CALIFORNIA

Forest.—Boston capitalists have acquired the Kate Hardy from Will M. Beggs and associates of San Jose. New work has begun under direction of E. C. Montgomery and additional equipment ordered. The tunnel is to be driven further on the orebody and the shaft sent 400 ft. deeper to open the vein in depth.

Forest Hill.—The new cross-cut tunnel at the Georgia Hill gravel mine is in 200 ft. and is expected to intersect the buried channel within 1300 ft. The tunnel is advancing 10 ft. daily with two shifts. Additional equipment has been ordered. The property is three miles from the Baltimore property and is under management of Anthony Crafton.

Sierra City.—Marion Westall, P. R. Loeffler, and J. E. Westall have erected an 18-ton Gibson mill at their Martini mine, together with a 5-hp. gasoline engine. Surface buildings have been built and arrangements made for steady winter operations.

Taylorsville.—Feather River Copper Co. has ordered complete equipment for Snowstorm copper group, adjoining properties of Engels Copper Co. Arrangements have been made for delivery of electric power, and new main tunnel is in 250 ft. The company is composed of Arizona copper men, headed by George W. Long, of Phoenix.

West Point.—An 8-ft. lode of low-grade ore accompanied by a 13-in. shoot sampling $120 in gold has been uncovered in the River mine, near the Mokelumne river. R. V. Montgomery, the manager, is planning to mill 2000 tons of $7 to $8 ore stored on the dump.

IDAHO

Coeur d'Alene.—There has been a different spirit in the Coeur d'Alene region since the conclusion of the strike, according to James F. McCarthy, president of the Hecla Mining Co., Wallace. The people are feeling better, and the supply of labor is larger than when the strike occurred. The Hecla mill is being operated on a basis of a shift a day. A second shift will be employed in another week and the third shift in two weeks. Operations will soon be resumed in a few days on the 2000-ft. level.

Kellogg.—The Bunker Hill & Sullivan Mining & Concentrating Co. has plans for an expansion of its smelting business and will enter the market with the intention of obtaining more custom ore, according to an official admission. The company has secured the services of Frank M. Smith, a metallurgist, who has been appointed assistant director of the smelting department. It will also establish an office at Spokane to facilitate the conduct of its business in several departments.

NEVADA

Carson City.—A. R. Argersinger, president of Nevada Protective Co., announces orders have been placed for a 30-hp. electric hoist, and that sinking of a 400-ft. vertical shaft will start about December 15. Foundations for the 75-hp. compressor are in place. Arrangements have been made to furnish air for two drills on the tunnel of the adjoining Comstock Superior group.

Discovery of an 8-ft. vein of $16 ore is reported by the Southwest Comstock Extension Co. The ore was found near surface at the portal of a tunnel being driven to intersect the Roberts vein at a depth of 75 ft. From this point a 100-ft. shaft will be sunk on the orebody.

Goldfield.—The main orebody has been opened to a depth of 140 ft. below the 330-ft. level of the Crackerjack shaft and continues 10 ft. wide. H. G. McMahon, the manager, reports assays range from $17.50 to over $19 per ton. Arrangements are being made to increase the working force preliminary to sinking the winze deeper and opening a new level.

Kimberly.—Sinking the Alpha shaft of the Consolidated Coppermines Co. has just been started. The present depth

1440 ft. and it is planned to extend it an additional 400 ft. at this time. Diamond-drilling from the 1300-ft. level is proceeding and will be continued until definite information is obtained as to the depth at which sulphides occur. The present hole, which is the third one drilled, passed through 48 ft. of oxidized ore that averaged 8.5% copper, with an average of 2% for an additional distance of 90 ft. Ore production has been resumed and will be continued on a limited scale. Shipments from the Alpha mine are at the rate of about 100 tons per day, and considerable ore is also going forward from the Liberty Pit, where the Nevada Consolidated is mining ore from Coppermines ground and concentrating it at the Steptoe works under the existing contract between the two companies. The company has been fortunate in securing the services of E. P. Mathewson as consulting engineer.

Mandalay.—A new mining district, called the Mandalay, has been organized in Humboldt and Pershing counties, chiefly in the former. The principal mines at work in the new district are the Mandalay group, the Haystack, Craven, and the Big Six, the last being operated under the direction of George Kislingbury of Los Angeles.

Red Hills.—Florence is prospecting the Florence vein in virgin territory south of the 550-ft. level and storing ore for shipment. Seams and bunches assaying $40 to $75 per ton are found with the lower-grade material and it is planned to ship to the Kennett smelter when this plant resumes. Fifteen men are employed.

Rochester.—The November production of the Nevada Packard Mines Co. was $27,000, mostly silver. The bottom of the Kromer workings is in 80-ounce ore.

Yerington.—Mason Valley Mines Co. has arranged for treatment of 2500 tons of 8% copper ore from the Northern Light mine at the Thompson smelter. The property has been worked under lease and option several months, but it is understood it will be turned back to owners because of failure to develop a sufficient tonnage of ore. The Northern Light is 18 miles from Yerington.

WASHINGTON

Danville.—The Laflour Mountain Copper Co., with properties near Danville, is ordering a $10,000 equipment for development and production. Ore will be taken from the Comstock shaft and from the Walla Walla claim. This company is practically free from debt with title to 100 acres covering six claims and four fractions.

Spokane.—Officers and directors for the Northwest Mining Association, with head offices at Spokane, have been elected as follows: Frank A. Ross, president; G. B. Dennis, retiring president; Frank C. Bailey, secretary; J. V. Richards, mining engineer; Edward Pohlman, broker and director of Spokane stock exchange; J. C. Haas, mining engineer, and O. Jeldness, mine manager. The association's financial condition is satisfactory.

BRITISH COLUMBIA

Ainsworth.—The Florence Silver Mining Co., operating near Ainsworth, has increased its milling operations to two shifts daily, according to F. R. Wolfle, its president.

Cambourne.—E. Bodine will take charge of the Beatrice mine at Cambourne, owned by the New Era Mines Co., and will develop the property and make shipments simultaneously. Operations will continue through the winter. Work will be done in No. 2 tunnel, the face of which is in ore.

Rhondel.—An orebody discovered on the Kirby claim has been cross-cut for 17 ft. without disclosing the foot-wall. Part of the vein is reported to contain milling ore in which there is a five-inch streak carrying 100 oz. of silver per ton. The property was staked last spring. The promise of the ground has prompted its owner, W. T. Kirby of Winnipeg, to form a syndicate of four persons to finance development.

Personal

The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

W. J. Loring has gone to Boston.

Frank R. Wicks is at Neihart, Montana.

Hallet R. Robbins is at Manchester, New Hampshire.

C. A. Banks has moved from London to Vancouver, B. C.

S. S. Sorensen, manager for the Braden Copper Co., is in New York.

H. F. Strangways is with the Cerro de Pasco Copper Corporation in Peru.

Olaf P. Jenkins is now geologist to the Sinclair Consolidated Oil Corporation.

R. C. Gemmell is at Duluth. He will visit Chicago on his return to Salt Lake City.

R. H. Channing, president of the Utah Consolidated Mining Co., is at Salt Lake City.

R. F. Haffenreffer, Jr., of Boston, president of the Utah-Apex Mining Co., is at Salt Lake City.

J. E. White has opened an office in the Bothin building, Santa Barbara, as consulting engineer.

Arthur E. Wells, of the U. S. Bureau of Mines, now stationed at Salt Lake City, was here this week.

Carlos W. Van Law has joined the staff of the Sinclair Consolidated Oil Corporation, in New York, where he is now residing.

D. E. A. Charlton, managing editor of the 'Engineering & Mining Journal', of New York, is now stationed in San Francisco.

Raymond F. Bacon, director of the Mellon Institute of Industrial Research, at Pittsburgh, and E. R. Weidlein, associate director, are at Salt Lake City.

Z. Nanase and **Tomizo Sasabe** of the Mitsubishi Co., of Tokyo, have finished their visits to American mining districts and sailed for Japan last Saturday.

A. B. Parsons, metallurgical engineer on the staff of the Butte & Superior Mining Co. will become an associate editor of the 'Mining and Scientific Press' on December 1.

F. Yamada, mining engineer at the Ashio mine of the Furukawa Mining Co., Japan, has been visiting Western mining districts. He sailed for Yokohama on November 8.

Lindsay Duncan, formerly chief engineer to the Nevada Consolidated Copper Co., and **Curtis Lindley, Jr.**, mining and construction engineer, have formed a partnership with headquarters in the Mills building, San Francisco.

Frank M. Smith, until recently manager of the East Helena smelter, has been appointed assistant-director for the Bunker Hill & Sullivan company, and will have his office at Spokane. He was in San Francisco this week.

Thomas S. Carnahan, who has been associated with the Utah Copper Co. in the capacity of mine engineer, has resigned to accept a position with the Katanga Copper Co. in the Belgian Congo, where he will have charge of all mining operations. He expects to sail for London in January.

Reuben E. Smith was drowned through the overturning of a boat on a river north of Vladivostok, early in October. It is suspected that this was not an accident. He was recognized as one of the most intelligent men engaged in prospecting in Siberia. His wife and two children are at Vladivostok.

THE METAL MARKET

METAL PRICES

San Francisco, November 10

Aluminum, commercial, cents per pound	[illegible]
Antimony, cents per pound	10 00
Copper, electrolytic, cents per pound	21 00 – 21 00
Lead, 100 cents per pound	7 00
Platinum, grain per ounce	$44 00
Platinum, 100 grain per ounce	$44 00
Quicksilver, per flask of 75 lb	$80
Spelter, cents per pound	9 50
Zinc dust, cents per pound	11 00 – 13 00

EASTERN METAL MARKET

(By wire from New York)

November 11.—Copper is inactive and easier. Lead is dull and steady. Zinc is quiet and firm.

SILVER

Below are given official or ticker quotations in cents per ounce of silver 999 fine. From April 23, 1918, the United States government paid $1 per ounce for all silver purchased by it, fixing a maximum of $1.01½ on August 15, 1918, and will continue to pay $1 until the quantity specified under the Act is purchased, probably extending over several years. On May 5, 1919, all restrictions on the metal were removed, resulting in fluctuations. During the restricted period, the British government fixed the maximum price five times, the last being on March 25, 1919, on account of the low rate of sterling exchange, but removed all restrictions on May 10. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the normal rate of exchange.

Date	New York cents	London pence	Average week ending	Cents	Pence
Nov. 5	123.75	66.75	Sept. 30	117.70	63.14
6	123.62	66.75	Oct. 7	119.56	63.71
7	123.62	66.75	14	117.44	62.83
8	123.62	67.00	21	117.95	63.98
9 Sunday			28	119.37	64.45
10	127.00	68.87	Nov. 4	122.20	66.16
11 Holiday			11	124.32	67.22

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	75.14	88.72	101.12	July	78.92	99.62	106.36
Feb.	77.54	85.79	101.12	Aug.	85.40	100.31	111.35
Mch.	74.13	88.11	101.12	Sept.	100.73	101.12	113.92
Apr.	79.51	95.35	101.12	Oct.	87.38	101.12	119.10
May	74.61	99.50	107.23	Nov.	85.97	101.12	....
June	76.44	99.50	110.50	Dec.	85.97	101.12	....

COPPER

Prices of electrolytic in New York, in cents per pound.

Date		Average week ending	
Nov. 5	21.25	Sept. 30	21.58
6	21.12	Oct. 7	21.35
7	21.12	14	21.72
8	21.00	21	21.87
9 Sunday		28	21.75
10	21.00	Nov. 4	21.37
11 Holiday		11	21.10

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	29.53	23.50	20.43	July	29.67	26.00	20.82
Feb.	34.57	23.50	17.34	Aug.	27.42	26.00	22.51
Mch.	36.00	23.50	15.05	Sept.	25.11	26.00	22.10
Apr.	33.16	23.50	15.23	Oct.	23.50	26.00	21.66
May	31.69	23.50	15.91	Nov.	23.50	26.00	....
June	32.57	23.50	17.53	Dec.	23.50	26.00	....

LEAD

Lead is quoted in cents per pound, New York delivery.

Date		Average week ending	
Nov. 5	6.75	Sept. 30	6.07
6	6.75	Oct. 7	6.16
7	6.75	14	6.25
8	6.75	21	6.43
9 Sunday		28	6.66
10	6.75	Nov. 4	6.75
11 Holiday		11	6.75

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	7.64	6.85	5.60	July	10.93	8.03	5.53
Feb.	9.10	7.07	5.13	Aug.	10.75	8.05	5.78
Mch.	10.07	7.26	5.24	Sept.	9.07	8.05	6.02
Apr.	9.38	6.99	5.05	Oct.	6.97	8.05	6.40
May	10.29	6.88	5.04	Nov.	6.38	8.05	....
June	11.74	7.59	5.32	Dec.	6.49	6.90	....

TIN

Prices in New York, in cents per pound:

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	44.10	85.13	71.50	July	62.80	93.00	70.11
Feb.	51.47	85.00	72.44	Aug.	62.53	91.33	62.20
Mch.	54.27	85.00	72.50	Sept.	61.54	80.40	55.79
Apr.	55.63	85.53	72.50	Oct.	62.24	78.82	54.82
May	63.21	100.01	72.50	Nov.	74.18	73.67	....
June	61.03	91.00	71.83	Dec.	85.00	71.52	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound:

Date		Average week ending	
Nov. 5	7.90	Sept. 30	7.38
6	7.90	Oct. 7	7.46
7	8.00	14	7.72
8	8.00	21	7.89
9 Sunday		28	8.10
10	8.00	Nov. 4	7.92
11 Holiday		11	7.96

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	9.75	7.78	7.44	July	8.08	8.72	7.78
Feb.	10.45	7.97	6.71	Aug.	8.58	8.78	7.81
Mch.	10.78	7.67	6.53	Sept.	8.33	9.58	7.52
Apr.	10.20	7.04	6.49	Oct.	8.32	9.11	7.82
May	9.41	7.92	6.43	Nov.	7.76	8.75	..
June	9.63	7.92	6.91	Dec.	7.84	8.49	..

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market according to quantity. Prices, in dollars per flask of 75 pounds:

Date		Oct. 28	85.00
Oct. 14	85.00	Nov. 4	80.00
21	80.00	10	80.00

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	81.00	128.06	103.75	July	102.00	120.00	100.00
Feb.	126.25	118.00	90.00	Aug.	115.00	120.00	103.00
Mch.	113.75	112.00	72.80	Sept.	117.00	120.00	102.60
Apr.	114.50	115.00	73.12	Oct.	102.00	120.00	86.00
May	104.00	110.00	84.80	Nov.	102.50	120.00	
June	85.00	112.00	94.40	Dec.	117.42	115.00	

MONEY AND EXCHANGE

The question of foreign credits is again agitating bankers, and recently there has been more serious consideration of the subject. Several things have occurred to revive the urgency of extending foreign credits. With the defeat of various proposed amendments, indications point to ratification of the peace treaty before long. The Edge bill awaits only approval of the President. The recent World Cotton Conference at New Orleans and the Foreign Trade Convention at Atlantic City showed how vital was the necessity for financing Europe. And last but not least, the large falling off in our export balance last month has brought home to bankers that something must be done, and done quickly, if we are to maintain anything approaching our past movement of export abroad.

There has been a widespread complaint in commercial centres over impracticability of the machinery so far proposed or created for facilitating shipments to Europe under conditions which require extension of long-term credits. There has already been one definite step taken—amendment to the War Finance Corporation act, which authorizes that corporation to make advances for this purpose to an aggregate amount of $1,000,000,000. But it is significant that this provision has not been resorted to—and to all practical purposes it remains a dead letter. Shippers contend that they cannot do business with Europe in this way. Although they may be able to discount notes of their foreign buyers with the corporation, they are subject to a contingent liability until the debts are paid. What the merchants want is that the corporation should find the dollars, or cash, for the exporters and assume, itself, the responsibility of the foreign credit.

In connection with the critical situation regarding our foreign trade, the following tabulation from the Boston News Bureau, giving exports and imports by groups for two periods in 1918 and 1919, is illuminating. (000 are omitted):

	—September— 1919	1918	—Nine months— 1919	1918
Imports:				
Crude materials	$201,610	$105,620	$1,153,398	$944,190
Foodstuffs, crude	62,919	28,331	378,046	270,160
Foodstuffs, manufactured	53,434	25,018	428,946	370,037
Manufactures for further use	58,845	63,173	407,822	473,689
Manufactures for consumption	54,503	38,353	313,913	304,916
Miscellaneous	4,050	870	14,845	9,559
Total imports	$435,384	$261,668	$2,696,973	$2,322,553
Exports:				
Crude materials	89,544	95,125	1,042,079	657,181
Foodstuffs, crude	67,887	84,405	517,344	347,078
Foodstuffs, manufactured	124,613	76,915	1,567,767	1,091,310
Manufactures for further use	93,043	92,810	701,543	824,804
Manufactures for consumption	206,216	191,134	1,896,354	1,552,361
Miscellaneous	754	1,430	8,809	14,541
Total domestic	$582,058	$541,821	$5,733,900	$4,487,278
Foreign merchandise	14,441	8,574	135,747	71,826
Total exports	$596,499	$550,395	$5,869,647	$4,559,104

Quotations on November 10 are as follows:

Sterling:	Cable	4 15½
	Demand	4 14½
Francs:	Cable	8 79
	Demand	8 77
Lire:	Demand	11 36
Marks		2 90

Eastern Metal Market

New York, November 5.

Dullness pervades all the markets. The unusual strike conditions are the cause of almost universal hesitancy of buyers.

Copper has declined in price on light demand and offerings by outside sellers.

The spot tin market is strong but the general market is inactive but firm.

Demand for lead has slackened but prices continue steady.

The zinc market has had a slight reaction from the low levels, from which it has recovered partly.

There has been no recorded change in the antimony market.

IRON AND STEEL

The coal strike has not yet had any appreciable effect on production of iron and steel because of large stocks of coal already accumulated. Non-union mines supply the Steel Corporation with its coking coal and independent companies obtain theirs from both union and non-union mines. Merchant blast-furnaces would likely feel the shortage of fuel sooner than such steel companies, but there is no immediate danger of a shut-down. A further return of strikers to steel plants is recorded each week and there is no indication that the coal strike will help the steel strike materially. October pig-iron output, according to 'The Iron Age', was 1,863,558 gross tons, or 60,115 tons per day, against 2,487,965 tons in September, or 82,932 tons per day, a falling off of almost 25%. Three weeks of September were free from the strike. In the last ten weeks improvement has been marked. For the month the net gain was 51 furnaces, 213 being in blast on November 1 against 162 on October 1. Some pig-iron makers have withdrawn quotations because of uncertainty as to fuel prices. Export sales of steel and pig-iron for October have probably equalled the best months of the year, but shipments were only one-fourth as much because of strikes in New York ports. Western railroads are negotiating for 150,000 tons of rails, but no contracts are expected until the disposition of the roads is settled. The Pennsylvania has also inquired for 200,000 tons under the same conditions.

COPPER

Partly because of a more aggressive attitude by producers in selling copper, and partly because of the strike situation in coal as well as in steel, the market has eased off and what inquiry there was has diminished. Buyers are less anxious to place orders and are inclined to await developments. As a result prices have declined so that today electrolytic can be bought as low as 21.25c., New York, for November delivery and perhaps December and it is possible that 21c. could be done. Lake copper is from ¼c. to ½c. above electrolytic, which we quote at 21.25c., New York, as a fair average of the market. It is known that this has been done recently on a fair business.

TIN

A moderate business has been quietly done in the last week for all positions, including spot, ex-steamer at dock, metal in transit or unloaded and future shipment—so much so that on the surface there was little evidence of this buying and the market appeared quiet. While the demand which resulted in business was not brisk, buyers appeared to be more confident as the steel strike wanes. This condition may be upset by the coal strike, but feeling is optimistic rather than otherwise. The longshoremen's strike continues the dominating factor. The situation is better, however, several thousand strikers having returned to work and this has been reflected in the price for spot Straits, which was 56c., New York, on Monday, yesterday being a holiday because of elections. Quotations for future shipment from the East are about 53c., with metal on steamers arrived or at dock at 53c. to 53.25c., New York. The tin statistics for October show 2875 tons arrived in the month, of which 400 tons came in at Pacific ports. The quantity in stock and landing was 7560 tons, which reveals the effect of the longshoremen's strike. Total imports to November 1919 has been 25,896 tons, against 51,603 tons to November 1, 1918.

LEAD

The market has been quiet but very steady. Quotations are unchanged both for the leading interest and for the independent sellers at 6.50c., St. Louis, or 6.75c., New York, for November delivery. If anything, the tone is a little heavy, which is taken to mean that the peak of the present movement has been possibly reached. The market seems to be at present on a day to day buying basis.

ZINC

Demand has been less active and quotations have receded. Prime Western for November delivery fell to 7.45c., St. Louis, last Friday, but has since advanced again until the present price is about 7.55c., St. Louis, or 7.90c., New York, 20 points lower than a week ago. British export and domestic buying is light, but a better export demand is looked for in the near future. Galvanizers are buying for nearby necessities. In the face of the present strike, both steel and coal, the market has been characterized as remarkably stable. In view of the present prices of the metals and commodities as related to pre-war prices, 8.50c. for zinc is deemed fair and probable when affairs become more normal. To what extent the coal strike will affect zinc production is not known.

ANTIMONY

Demand is light and conditions are unchanged with quotations at 8.75c., New York, duty paid, for wholesale lots for early delivery.

ALUMINUM

Virgin, 98 to 99% pure, is nominal at 32c. to 33c., New York, for wholesale lots for early delivery.

ORES

Tungsten: The market continues to mark time, demand being very light because of both the steel and coal strikes and the tariff matter. One report is to the effect that high-grade Bolivian ore has sold as high as $10 per unit, but the case is an isolated one. About $1.25 per pound of contained tungsten seems to be the nominal quotation of ferro-tungsten.

Molybdenum: Quotations are nominal at 75c. per pound of MoS_2 in regular concentrates, in a market practically devoid of demand.

Manganese-Iron Alloys: Foreign demand for spiegeleisen continues to be the feature of this market. Inquiries and sales total around 5000 tons in the last week, which is over and above the 10,000 tons reported sold a week or two ago. Domestic demand is expressed in inquiries for almost 2000 tons, with about 1000 tons sold at the market quotation of about $35, furnace. Demand for ferro-manganese is light. British producers have withdrawn temporarily from the market and carload lots of American alloy have sold at $115, delivered, which is the market quotation for this year and first quarter.

Ferro-chrome: Sales have been made as low as 25c. per pound of contained chrome in 60 to 70% alloy, 6 to 8% carbon. There has been an increase in output, evidently caused by new producers.

Book Reviews

Induction Coils in Theory and Practice. By F. E. Austin. Pp. 61, ill., index. F. E. Austin, Hanover, N. H. For sale by 'Mining and Scientific Press' Price, $1

This book is divided into 16 lessons, each of which considers some division of the subject. The explanation of the theory is illustrated by a number of practical examples. The book will be of value to both the student and the electrician.

Analysis of Babbitt. By James Brakes. Pp. 169. Allen Book & Printing Co., Troy, New York. For sale by 'Mining and Scientific Press'. Price, $2.

This book describes the various methods for determining the chemical constituents of a given 'babbitt' mixture, and also gives some data on the manufacture of babbitt metal. About half the volume is devoted to a remarkably complete bibliography of the various subjects treated. The book will be useful to persons engaged in the manufacture or testing of babbitt metal.

Examples in Magnetism. By F. E. Austin. Pp. 86, ill., index. F. E. Austin, Hanover, N. H. For sale by 'Mining and Scientific Press'. Price, $1.10.

While this book is primarily intended as a textbook for the student it will also be useful to the engineer. The introductory part of the book discusses weights and measures as applied to magnetic problems and also gives a brief review of trigonometry in so far as it concerns these same problems. The remainder of the book is devoted mainly to the statement and demonstration of the principal magnetic propositions illustrated by examples.

Iron and Steel. By Erik Oberg and Franklin D. Jones. Pp. 321, ill., index. The Industrial Press, New York. For sale by 'Mining and Scientific Press'. Price, $2.50.

This is a 'popular' book on the iron and steel industry written in non-technical language. The first chapter is devoted to definitions and to notes on the history and to general aspects of the industry. Then follow chapters on iron ore, pig-iron, wrought-iron, steel in general, crucible steel, bessemer steel, open-hearth steel, electric steel, rolling-mill practice, alloy steels, high-speed steel, cast-iron, and steel castings. It will readily be seen that in a book attempting to cover such a large field, the treatment of any particular subject must necessarily be brief, but with these limitations in mind, the book may be said to give an excellent 'bird's-eye view' of the industry.

The Mineral Industry. Vol. XXVII, 1918. Edited by G. A. Roush; assistant editor, Allison Butts. Pp. 937 + xix. Index and many tables. McGraw-Hill Book Co., Inc., New York. For sale by 'Mining and Scientific Press'. Price, $10.

Volume XXVII of this annual review of the mining and smelting field is well up to its predecessors, although the end of the War is still too recent for full information to be available regarding the status of the industry in most foreign countries. Belgium is a notable exception, that sorely-tried country having published, within three months of the German evacuation, a full report of the production of the occupied territory for the period of the War, as well as the condition the various plants were left in by the retreating Germans. As the editors point out, this example might with great benefit to the industry be followed by some of the more favored of the belligerent nations; until such reports have been made, much of the material will necessarily need to be treated from the American standpoint.

The general scope of this annual résumé of the mining field is too well known to the profession to require extended comment here; almost all that is needed is to call attention to its publication. The plan of the preceding volumes has been followed, each branch of the industry being discussed in an individual chapter, alphabetically arranged. As a work of reference it would seem to be indispensable to everyone engaged in the business of mining, except in the narrowest field.

Recent Publications

The Vapor Pressure of Lead Chloride. By E. D. Eastman and L. H. Duschak. Technical Paper 225, U. S. Bureau of Mines, 1919. Pp. 16, ill.

Tin in 1918. By Adolph Knopf. I:3, U. S. Geological Survey, 1919. Pp. 9. From Mineral Resources of the United States, 1918—Part I.

Preparation of Fuller's Earth. Excerpts from Monthly Reports on Minerals Investigations of the U. S. Bureau of Mines, for August, 1919. Pp. 2.

Mica. By D. A. Hill. Political and Commercial Control of the Mineral Resources of the World, No. 22, Department of the Interior, 1919. Pp. 16, map.

Silver. By F. W. Paine. Political and Commercial Control of the Mineral Resources of the World, No. 20, Department of the Interior. Pp. 17, map.

Phosphate Rock in 1918. By Ralph W. Stone. II:9, U. S. Geological Survey, 1919. Pp. 23. From Mineral Resources of the United States, 1918—Part II.

Copper. By F. W. Paine. Political and Commercial Control of the Mineral Resources of the World, No. 1, Department of the Interior. Pp. 55, map, tables.

Chromite. By E. C. Harder. Political and Commercial Control of the Mineral Resources of the World, No. 24, Department of the Interior, 1919. Pp. 42, map.

Asbestos. By Oliver Bowles. Political and Commercial Control of the Mineral Resources of the World, No. 21, Department of the Interior. Pp. 21, map, diagram.

Bauxite and Aluminum. By J. M. Hill. Political and Commercial Control of the Mineral Resources of the World, No. 19, Department of the Interior. Pp. 12, map.

Coal in 1917. Part A. Production. By C. E. Lesher. II:32, U. S. Geological Survey, 1919. Pp. 147, table. From Mineral Resources of the United States, 1917—Part II.

Manganese. By D. F. Hewett. Political and Commercial Control of the Mineral Resources of the World, No. 25, Department of the Interior, 1919. Pp. 35, map, diagrams.

Antimony. By H. G. Ferguson and D. A. Hall. Political and Commercial Control of the Mineral Resources of the World, No. 28, Department of the Interior, 1919. Pp. 28, map.

Nitrogen. By Chester G. Gilbert. Political and Commercial Control of the Mineral Resources of the World, No. 30, Department of the Interior, 1919. Pp. 31, map, table, diagram.

Surface Water Supply of Hawaii, July 1, 1917 to June 30, 1918. Nathan C. Grover, Chief Hydraulic Engineer, C. T. Bailey, Acting District Engineer. Water Supply Paper 485, U. S. Geological Survey, 1919. Pp. 167, index.

Oil Shale in Western Montana, Southeastern Idaho, and Adjacent Parts of Wyoming and Utah. By D. Dale Condit. Bull. 711-B, U. S. Geological Survey, 1919. Pp. 26, map. From Contributions to Economic Geology, 1919. Part II.

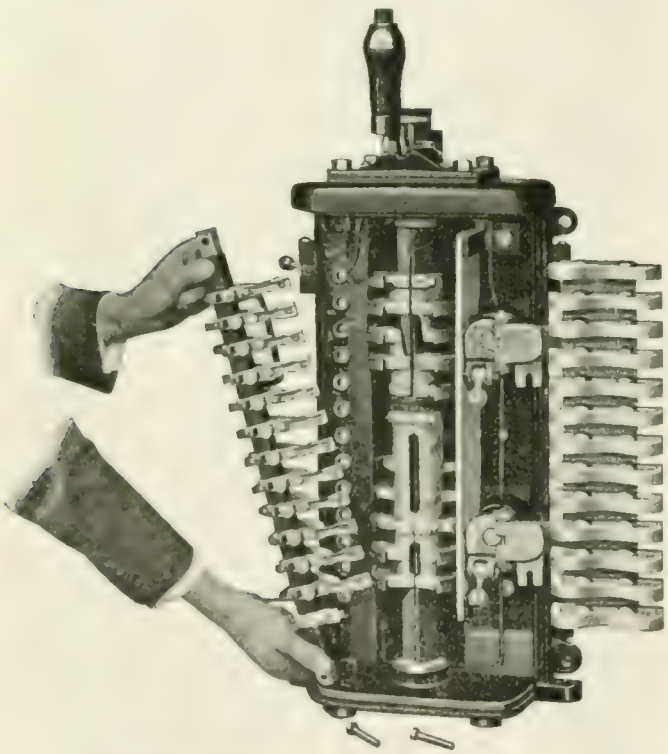
Report of a Joint Committee Appointed from the Bureau of Mines and the United States Geological Survey by the Secretary of the Interior to Study the Gold Situation—October 30, 1918. Bull. 144, U. S. Bureau of Mines, 1919. Pp. 84, index.

INDUSTRIAL PROGRESS

INFORMATION FURNISHED BY MANUFACTURERS

A NEW CUTLER-HAMMER BOOKLET

'C-H Drum Controllers' is the title of a new four-page two-color 8½ by 11 folder, which has been prepared by **The Cutler-Hammer Mfg. Co.,** Milwaukee. It gives prominence to the outstanding features of C-H drum controllers, which have won for them an enviable position in the drum controller field. Three of the features are: accessibility, interchangeability of parts, and interchangeability of methods of



C-H Drum Controller, Showing the Construction

manipulation. Any C-H standard stock drum can be equipped with either rope, radial, or straight line drive and these are interchangeable. The folder plays up other points, such as the ease with which the contact fingers and the cylinders may be removed; the absence of wood in construction; the square metal shafts; and the straight non-stubbing fingers. Dimensions, rating, and other engineering data are given. Three types having common dimensions comprise five bulletin numbers, capable of controlling AC and DC motors from 1 to 100 hp. The folder has been prepared especially for the St. Louis convention of the Association of Iron and Steel Electrical Engineers, but is also being forwarded to those interested in drum controllers. The accompanying cut, showing the controller with the cover removed, indicates how the contact fingers may be removed after taking out a bolt at top and bottom. Electric haulage is coming to play such an important part in underground tramming that details of accessory equipment such as these C-H drum controllers are interesting and valuable to mining engineers.

WESTINGHOUSE TURBINES IN THE FAR EAST

Two 25,000-kw. steam-driven turbine units of Westinghouse make, which, when installed, will complete the largest steam-driven electrical installation in the Far East, are now being erected at Osaka, Japan, for the Osaka Electric Light Co. Situated in an extensive industrial district, this company furnishes light and power to street railways, steel works, ship builders, copper refining plants, paper mills, electro-chemical installations, and other industries. It is noteworthy that in 1908 the Osaka company installed three steam-turbine units of 3000 kw. each. In 1910 two more units of like capacity were added, and in 1911 two 5000-kw. units. The 25,000-kw. units now being installed will bring the capacity of this plant up to 100,000 hp. All of the above units are of Westinghouse manufacture.

COMMERCIAL PARAGRAPHS

The Jerry Johnson 100-ton cyanide mill at Cripple Creek is being dismantled by the **Morse Bros. Machinery & Supply Co.,** of Denver. This mill, erected in 1914 and used but a few months, was completely equipped with Dorr thickeners, agitators, and classifiers, Oliver filter, etc. The material is being shipped to Denver for re-sale.

Lea-Courtenay Co. of Newark, New Jersey, has recently issued two new bulletins—one, termed H-4, on centrifugal pumps as well as a catalogue of its most complete line. The other bulletin, S-5, is a synopsis of typical centrifugal pumps installed in various industries, showing the wide range of pumping service which Lea-Courtenay centrifugal pumps cover. A copy of either of these bulletins may be had on application to the company.

Allis-Chalmers bulletin No. 1537 deals with details of Diesel-type oil engines, and is intended to be used when ordering repairs and spare parts. It contains 30 pages of diagrams and illustrations, each part being indicated and named so clearly that no mistake is possible. All that is necessary when ordering new parts is to give the name of the part wanted, as found in this bulletin, together with the size of the engine and the number of the cylinder.

Catalogue No. 17 of the **National Compressed Air Machinery Co.,** Los Angeles, is just off the press. This is an attractively assembled booklet of 32 pages, and contains a wealth of detail that will be useful to anyone who is interested in obtaining small-capacity units, self-contained, for compressing air. The catalogue is well-illustrated with photographs of parts and assembled units, line drawings giving erection dimensions, and many tables containing valuable data on compressed air. Only stock models are illustrated, but the company invites correspondence on problems that could not be covered within the limits of the catalogue. When it is stated that the compressors described range in capacity from 1.6 ft. to 854 ft. of free air per minute at normal speeds, with considerable overload capacity, it will be realized that the variety of models is sufficient to cover any requirements.

IF you want to read a fair, incisive, and judicious analysis of the labor problem as it exists today, read the first five pages in the 'Outlook' of October 29.

APROPOS of an editorial paragraph in our last issue, we note with interest that Judge Mark R. Averill, of Tonopah, in passing upon a demurrer filed by representatives of the I. W. W. in Nevada, denied the right of free political criticism to aliens. The right of "saying orally what he pleases . . . extends only to citizens of the United States. It is not a privilege extended to unnaturalized persons", or, we infer, those who have failed to declare their intention of becoming citizens. The Court ruled further that whereas strikes are lawful, "that does not mean that strikes for political purposes or to subvert government are lawful". All of which seems to us to be sound doctrine and worthy of acceptation.

AMONG dividends paid by mining companies we note the 850% declared recently by the Premier (Transvaal) Diamond Mining Company, of South Africa, on its operations during the last fiscal year. Moreover, it is rumored that the twin of the celebrated Cullinan diamond has been found. The Cullinan, which was found in 1905 and weighed 3024 carats, or 1.7 pounds, before being cut, is supposed to have been "a cleavage fragment of a much larger octahedral stone", according to Dr. Wagner. It may be that this other half has been found. The Cullinan diamond was too large for ordinary use, so it was sold for a nominal price of $500,000, in order that the South African government might present it to King Edward on his coronation.

SILVER has risen to the highest price within half a century, and it is not surprising, having regard to the world-wide demand for subsidiary coins. Paper money was created lavishly during the War, without a corresponding increase of the minor coins needed in daily business. It is reported, for example, that in the French provincial cities, as well as in Paris, it is becoming increasingly difficult to get change for a 5-franc or a 10-franc note. In a great city like Toulouse it was found necessary during the War to use metal tokens and pieces of cardboard as substitutes for centimes. Today conditions are no better, so that a purchaser cannot be supplied with goods in a store unless he is prepared to give the exact amount of his purchase, for no change is given. This scarcity of smaller coins exists despite the fact that the French government during the last five years has issued more silver coinage than during the preceding 35 years. Part of the scarcity is due to a distrust of paper money among the peasantry, but it is due also to the depreciation of French paper money and the smuggling of French silver coins across the border into Switzerland, Italy, and Spain, where the 5-franc, 2-franc, and 1-franc pieces are melted down by speculators.

BY the death of Dr. Martin D. Foster, the War Minerals Relief Commission has lost one of its members, and a new one will have to be nominated by the Secretary of the Interior. Another appointment to be made is that of a successor to Mr. J. E. Spurr as Chief Engineer to the Commission. The Committee on Mines and Mining of the House of Representatives seems to favor a more liberal treatment of claims under the Act and may support remedial legislation to that effect. More than 350 cases have been disallowed under the Attorney-General's technical interpretation. It is stated also that deductions from claims for amounts made in payment of properties will further reduce the total of compensations under the Act by nearly a half.

WE regret to learn of another outrage perpetrated on a member of our profession in Mexico. On November 5, at San Javier, in Sonora, an attempt was made to murder Mr. George A. Kennedy, assistant superintendent of the mine owned by the W. C. Laughlin Company. A number of Mexican workmen attacked him from behind while he was discussing a fancied grievance presented by one of them. He was knocked down, beaten on the head, and shot through the thigh, the bone being shattered. Mr. Kennedy is a graduate from the Colorado School of Mines and had been at the mine a year. He is now at the Sisters' Hospital, at Nogales, Arizona. Four American employees have been killed at the San Javier mine, two during the current year, yet no one has been punished. The man that shot Mr. Kennedy is under arrest, but he is the hero of the town. We trust that the matter will receive attention from the State Department at Washington.

WORK has been resumed in the mines of the Tonopah district, the strike having come to an end definitely on November 8, after more than one abortive settlement. The strike was called on August 17, and on October 4 it was declared off by the craftsmen, that is, the skilled

workers leaving the radical or I. W. W. element in the cold. This was followed by the organization of a local or domestic union, entirely unaffiliated with any national organization, and distinct from the local I. W. W. group. An injunction was issued by the District Court, on petition of the Governor, to prohibit meetings and demonstrations intended to prevent the miners from resuming work. So a fresh start was made, but on November 1 a demand for an increase of $1 per day was made by the new union. This was under discussion when, with the approval of the Federal Mediator, Mr. A. E. Lord, the companies agreed to pay a bonus of 50 cents per shift and to establish a general commissary by means of which the miners could obtain all necessary supplies at cost, with the provision that when it had been established to the satisfaction of the Federal Mediator, there would be an automatic return to the former scale of wages. It was also agreed that, when this was done, the companies would not charge more than $37.50 for board as against, say, $45 at the present time. This was accepted by the men, and an agreement was signed making it binding on both sides to August 15, 1920.

ESTIMATION of the average cost of producing copper is recognized as difficult, on account of the varying proportion of the precious metals yielded by copper ores and of the other by-products of the industry. We note that the Federal Trade Commission has ventured to make an estimate of the cost of producing copper in 1918. The report of the Commission is based upon information from 85 companies, producing 95½% of the total output in the United States. The average cost is given as slightly more than 16 cents per pound, and it is stated that more than 85% of the production was made at a cost of less than 20 cents, indicating that the remaining 15% must have been produced at less than 7 cents per pound. The companies exploiting ore of the disseminated type, usually known as the 'porphyry' group, incurred a cost of less than 15 cents per pound; how much "less" the report does not say. These contributed 34% of the total output. The profits of the copper companies were "very high", says the report, under the Government schedule of 23½ cents established on September 21, 1917, and raised to 26 cents on July 2, 1918, during the War. The profit realized for the year averaged 28% on an investment of $672,000,000.

FROM an experienced mining engineer just returned from the Salmon River district, in British Columbia, we learn that the Premier promises to be one of the big mines of the world. He speaks well of the district and says that there are three nearly parallel vein-formations, the first of a comparatively low-grade character, marked by the Big Missouri, Province, Payroll, Indian, and Lake & O'Leary prospects; the second a high-grade lode-channel marked by the Forty-Nine, Mineral Hill, Big Missouri, Northern Light, Cobalt, and Premier; and a third marked as yet by only one prospect of any importance, the Spider. These are generalizations, of course. The low-grade belt shows rich ore in places. The Big Missouri group [illegible] and includes claims on two lines of vein-formation. The country-rock is mainly greenstone, which is traversed by dikes of granitic and dioritic character. The ore is a silver-lead mineral, containing lead as galena and silver as native, stephanite, and proustite. Zinc appears in some of the lodes, especially in the claims along the Bear river. The pyritic ore assays several ounces in gold, but the Premier bonanza is a silver-lead ore, the high-grade containing 300 ounces of silver per ton and 30% lead. Two mining towns have been established, namely, Stewart on the Canadian side and Hyder on the American; they are only 1½ miles apart and the Alaska-British Columbia boundary passes between them. Both are on navigable water and can be reached by steamer from Prince Rupert in 10 hours. From Vancouver the district can be reached in 36 hours, by boat. There are about 250 people there now, and it appears likely that a rush will ensue next spring.

FROM Johannesburg and from London we hear that dealings in South African mining shares have been greatly increased of late, so much so that there is talk of a Kaffir 'boom'. One correspondent says that "enormous activity has developed on the Johannesburg stock-exchange". The London financial papers are printing articles on "the Kaffir revival" and are giving their readers information concerning sundry neglected stocks that appear to have "speculative merits". The reason for this cheerful condition is the free market for gold and the substantial premium that the South African product now commands in London. By the way, we note that the 'South African Mining Journal' imputes the activity of certain stocks, such as Consolidated Mines Selection, Anglo-Americans, Springs, and Brakpans, to American participation in share speculation, and says "it is understood that Anglo-Americans and kindred stocks are about to be introduced on Wall Street. This is regarded as a most decided bull point. America is today literally overflowing with wealth, and if American financiers take an interest in Main Reef stocks and shares, we shall certainly see enhanced prices for stocks and also tap another source of capital supply for the development of new areas". This is interesting, but we think that the British income-tax and excess-profit tax together will deter any American from buying the shares of companies registered in London.

The Steel Strike

Of various phases of labor turbulence at the present moment, we select the strike of the steel workers on account of the report issued by a committee of the Senate that was appointed to investigate the subject. This committee consisted of senators from Iowa, South Dakota, Colorado, Tennessee, and Massachusetts; it was representative of the country as a whole and of both political parties. Although given to the press on November 8, the report has elicited but little comment; yet it was interesting and important. We find much in it that is timely. For instance, the report declares that "there is no place in this country either for industrial despotism

or labor despotism", and then it proceeds to identify strikes with "industrial barbarism", meaning presumably that a strike is a barbarous method of settling an industrial disagreement. It is; and a better way must be devised for the sake not only of the disputants themselves but of the community that suffers from such a barbarous method of adjusting economic contests. The committee properly concludes that the public has a right to demand that neither capital nor labor shall arrogate to itself the privilege of determining industrial controversies as it pleases, and the duty is upon Congress to provide a way out of the difficulty. As strikes at present appear to afford the only means by which labor can secure "even its just demand", it is recommended that Congress authorize the establishment of some agency of mediation, such as the recent War Labor Board. Such an agency "would have the power of compulsory investigation, but not to the extent of compulsory arbitration". It would be effective, however, because "a just decision would be endorsed by the public". The committee finds that some of the laborers in the steel-mills had a just complaint as to hours of work, but not as to wages. Sympathy is expressed with the principle of collective bargaining, but the Committee does not believe that the steel strikers took the right course in selecting such a representative as Foster, and "Judge Gary could well have objected to receiving a man with such views". However, Judge Gary's refusal was not put on this ground, but on the fact that the leaders did not represent the employees, although himself conceding that 10 to 15% of the men in the mills were unionized. Therefore the Committee holds that "even this 10 or 15% had the right to select their own representatives and present their grievances, and that they should have been heard". With this we agree. Judge Gary himself is a lawyer whom the Steel Corporation engaged as its representative; he is not a metallurgist nor an engineer; he is the publicity man for the Corporation. Testimony given before the Committee sustained the contention that a large proportion of the strikers are non-English speaking aliens and indicated that behind the strike was massed "a considerable element" of revolutionary radicalism represented by such a man as Foster. He and Margolia are mentioned as "dangerous to the country" and also "to the cause of union labor". The Committee considers that the American Federation of Labor made "a serious mistake and has lost much favorable public opinion by permitting the leadership of this strike movement to pass into the hands of some who have heretofore entertained the most radical and dangerous doctrines", and it states further that the same Federation "should purge itself of such leadership, in order to sustain the confidence the country has had in it under the leadership of Mr. Gompers". Since then Mr. Gompers has charged the Government with "violating the principles of democracy" by using the injunction to terminate the coal strike. Evidently Judge Gary's uncompromising attitude before the Labor Conference has had the effect of throwing Mr. Gompers into the arms of the radical faction, which was trying to unhorse him and which he had been opposing steadily. It is a great pity that the reactionary and the radical elements in this industrial quarrel should have been allowed to dominate the stage at this time when the more reasonable representatives both of the employers and the employees were showing signs of a conciliatory spirit, which is the only one that will solve the difficulties now facing American industry. We must have a reasonable spirit as between the two sides and a recognition on the part of both that they must conduct their disputes so as not to sacrifice the welfare of the community at large. The Government stepped between the coal operators and the coal miners in order to prevent injury and suffering to our whole population, and its action called forth such instant approval as to give a warning to the representatives of capital and labor alike that there is a limitation to their methods of warfare; in short, that we are not living in the jungle but in a state of civilization that calls upon every citizen to consider his obligations to the community and his duty to the nation.

Claims Against Mexico

In connection with the claims for damages brought by American citizens and companies against the Mexican government, a critical position has been created and calls for serious attention. In a circular issued by the Department of State, under the heading 'Application for the support of Claims against foreign Governments', the following occurs: "If any legal remedies for obtaining satisfaction for, or settlement of, the losses or injuries sustained are afforded by a foreign government before its judicial or administrative tribunals, boards, or officials, interested persons must ordinarily have recourse to and exhaust proceedings before such tribunals, boards, or officials as may be established or designated by the foreign government and open to claimants for the adjustment of their claims and disputes [and they must make affidavit that they have done so]. After such remedies have been exhausted, with the result of a denial of justice attributable to an official, branch, or agency of a foreign government, or have been found inapplicable or inadequate, or if no legal remedies are afforded, the Department of State will examine the claim with a view to ascertaining whether, in all the circumstances of the case and considering the international relations of the United States, the claim may properly be presented for settlement through diplomatic channels, by arbitration, or otherwise." This is unfair to those who have lost so much by the Mexican revolution, for the following reasons, each one of which could be elaborated. (1) The cost of bringing individual actions in each and every case is unnecessary and entails excessive cost. (2) What is there, in international law, to prevent the American government from employing an attorney to represent all American citizens? (3) The attorneys employed by individuals must be Mexicans or foreigners living under veiled threats of the Mexican government. (4) An agent of the American government, to examine these claims as presented and reserve them for discussion with the Mexican government when the proper time comes, would pre-

sent possible front, make uniform demands, and place all claimants on an equal basis. (5) The Mexican government is forming a commission, but it is hard to find a Mexican law made in late years that has not been introduced either to facilitate personal graft or for the purposes of personal revenge. (6) The American is forced to stoop to bribery in order to be able to run his business at all. Why should he be forced to do so by his own government when there is a remedy? (7) A person or corporation owning property in Mexico is entirely at the mercy of the Mexican government. If he invites its enmity by making a large claim upon it directly at this time, or before all claims are presented simultaneously, he may have his business ruined by the Mexican government. (8) On the face of it, there seems no reason for settling claims on different bases and by diverse methods, some questionable; there should be uniform justice and simultaneous payment, none having any advantage and none suffering through partiality. (9) Although repeatedly asked, our State Department is unable to say what can and cannot be claimed. There are a great many degrees of 'consequential' damages. No lawyer in the United States or elsewhere knows which of these can apply. This may be a reason for the Government wishing to disclaim responsibility. We commend these suggestions, made to us by a well-informed mining engineer in Mexico, to those of our readers whom the matter concerns; and of such there must be many.

Mining Speculation—II

In the second and third articles mentioned in our last issue, the writer, Mr. J. A. L. Gallard, deals with sundry technical questions, drawing his information from recognized text-books. It is pleasant to note that a financial journalist has taken pains to make himself familiar with at least a portion of the literature of mining technique. In the next two articles, he discusses ore-reserves and the way in which they are computed. He refers to some of the vagaries of custom in language studiously moderate. As a matter of fact, British mining companies, or rather their managers and directors, do some very queer things, meriting outspoken criticism. For instance, the reports of mines on the Rand show 'payable' and 'unpayable' ore, and include under the latter heading millions of tons of conglomerate that has no chance whatever of being exploited at a profit. The tonnage multiplied by the assay suggests to the layman a profit that is entirely illusory, but serves its purpose in giving a fictitious foundation for the market over-valuation of the company's shares. Two million tons of rock containing 2 dwt. of gold per ton will be listed as "unpayable *ore*" in a mine where the cost of mining and milling is more than the equivalent of 4 dwt. per ton. Another common camouflage is to quote, in official reports, a 'cost' that is fallacious to the extent of being as much as 50% understated. Owing to the 'over-head' expenses of mines operated at a distance from the home office and owing to the failure to deduct depreciation and plant-renewal from the gross expenditure before stating the cost per ton of ore, it is quite common to find the public mystified by figures of 'cost' that are utterly wrong, but which again serve to put the enterprise in a rosy light, enabling insiders to dispose of blocks of shares before the time of disillusionment arrives. The managers of the Indian gold mines give the tonnage of ore in reserve, but do not state its assay-value or the profit to be expected from it. The assumption is that the grade does not change from year to year, which, of course, is contrary to fact. No suggestion of a sinister purpose can be made in this case, for the managers, John Taylor & Sons, set a high standard of probity in their administration of these mines, but the practice is to be condemned unhesitatingly because if adopted by others less scrupulous it would afford plenty of chances for chicane. British companies publish monthly or weekly reports of production, and, in one instance that we recall, even a daily statement of output. This helps to keep the mine in the public eye and promotes share-dealing, for every deviation from the normal prompts either gratification or uneasiness as the case may be. The effort, usually well intentioned, to maintain a uniform production ends only too often in a collapse, the condition of the stopes compelling the manager abruptly to decrease his output, in tonnage or grade, or both, whereupon there is a debâcle in the share quotation and sometimes a scandal, which, however, does more harm to the unfortunate manager than to the directors, who usually 'find an alibi' somewhere. Mr. Gallard, of course, says none of these things. Financial journalism in London, even of the higher type represented by him, is not so independent as to dare to be so indiscreet. Indeed the London mining market suffers from the lack of fearless criticism, not of the small-fry promoters, but of the controlling financial houses. The next two or three of Mr. Gallard's articles do not call for comment. They give elementary information in a useful way. In his seventh, he discusses 'Working Costs and Profits'. He refers to sundry anomalies and recognizes that "it is quite possible for a mine to show a 'working profit' and to be actually operating at a net loss from the shareholders' point of view". Debenture charges, the Transvaal profit-tax, and London expenses are items likely to be obscured. Even to this day the Transvaal Chamber of Mines issues a monthly and an annual statement of the 'yield', 'cost', and 'profit' per ton, from which the innocent shareholder deduces the amount of dividend that will be coming to him. The 'cost' is absurdly misleading, for it fails to include a number of necessary items, not extraordinary, but ordinary. Thus whereas the total profit in 1918 was given officially as £7,678,129, the dividends, which constitute the only real profit to the shareholder, amounted to only £5,144,077, or two-thirds the amount stated. The fictitious average profit per ton for the Rand as published officially was 6 shillings, whereas the real profit was only 4 shillings per ton. It is remarkable that the Institution of Mining and Metallurgy should have failed to exercise a wise influence in persuading the Transvaal Chamber of Mines to correct this discrepancy, which is repeated month after month, and year after year.

The Discovery of Froth Flotation

The Editor:

Sir—In your article on this subject in your issue of July 19, I note that you use remarks of mine in an attempt to prove that Minerals Separation Company were not the inventors of the frothing process, which process has earned such immense additional profits to its users, some of whom you appear to defend in their efforts to avoid payment for the brief time of its patent life, or in other words, support those who deliberately endeavor to evade payment for a process that they would never have been able to apply had it not been for Minerals Separation Company and its staff of experts diligent application in the early life of the discovery.

In order to discount these efforts without which you would have had nothing to write about in this direction, you imply that Shellshear, Beauchamp, and Hebbard were well acquainted with the operation long before the patent was taken out. As a matter of fact, if you read carefully my paper of November 10, 1913, you will find it stated that the observed flotation of certain particles up to a certain time was not of commercial value and that the extension of the existing magnetic plant was consequently proceeded with; to quote my remarks:

"In the meantime the first experiments in flotation, to be described later, had been carried out, but the results being less satisfactory than those obtained by the magnetic process, and the No. 1 plant continuing to do satisfactory work, the second or No. 2 magnetic plant was erected in 1904."

To further clear the various points raised, it may be of interest to know that Mr. Shellshear was not in my employment before May 23, 1904, and that Mr. Beauchamp, although employed in underground work previously, did not come into contact with flotation work until June 19, 1905.

You are no doubt aware that in the preparation of blende for assaying purposes it had been observed for years that the particles persistently floated in the beaker to the annoyance of the assayer and it was not until 1901 that Potter turned this action into a partially commercial success.

In fairness to me and those who collaborated with me, I trust you will again peruse my paper wherein the story of flotation as far as Broken Hill experience is concerned is fully set out and that Mr. Higgins therein mentioned reported early in 1905 the first clear indication that flotation as now perfected was arriving at commercial success.

His report as quoted by me shows that the reduction of oil resulted in flotation instead of granulation and thereupon "the Wilfley tables of the original plant were then dismantled to make room for the sand-boxes already mentioned, and the granulation process gave way to the flotation process with simple spitzboxes late in 1905".

Melbourne, October 7. JAMES HEBBARD

[We are glad to hear from Mr. Hebbard. Fortunately both Messrs. Beauchamp and Shellshear were in San Francisco when his letter arrived, so that we were able to make further inquiry. Mr. Beauchamp says that Mr. Hebbard's statement concerning the period of his employment at the Central mill is correct, he having confused this employment with his previous active participation in flotation work. He re-asserts that both he and Mr. Shellshear tried and advocated the method of frothing some time before it was recognized by those in authority. It was not until the Cattermole granulation process had proved a failure that serious attention was given to floating off the sulphides in the form of a froth by means of spitzkasten. The advantages of this system were apparent at once and the plant was changed accordingly. Mr. Hebbard has stated that the discovery of froth flotation was made simultaneously at Broken Hill and London, and that the reports announcing the discovery crossed in transit. Credit for the discovery was given to the London laboratory, but Messrs. Beauchamp, Shellshear, and others had good reason for believing that the knowledge of the process was first obtained at Broken Hill. That belief is not shaken by Mr. Hebbard's letter. In regard to Mr. Shellshear, that gentleman also confirms Mr. Hebbard's statement in regard to his employment at the Central mill of the Sulphide Corporation. Turning to Mr. Hebbard's last paragraph, we refer those interested in the controversy to Mr. Hebbard's paper, published in 'The Flotation Process' and in our issue of September 4, 1915. It will be found that he there states that in December 1904 (the so-called discovery in London was made in March 1905) a test yielded "all float concentrate, *no granular material being formed*" by the use of only 0.75% oleic acid on the mineral, equivalent to 7 to 9 pounds of oil per ton of ore. Does not this test, made in Australia three months before the marvelous discovery in London, show that a reduction in the proportion of oil caused flotation rather than granulation? The Wilfley tables of the original plant were dismantled because the spitz-box proved more efficient for the purpose. Mr. Hebbard hints that this change was due to the report by Mr.

Higgins. This is not in accord with the facts. No Cattermole granules were ever produced in the large-scale plant in the Central mill because there was never sufficient oil for this purpose. All the work in this large-scale plant in its early stages was based upon an effort to float the mineral and otherwise separate it on Wilfley tables; and as the oil was reduced, the recovery of mineral from these tables was also reduced. It was not until the spitz-box was introduced that the process was developed into a practicable large-scale method of froth-flotation. The use of the spitz-box for this purpose was suggested by Messrs. Beauchamp and Shellshear, not by any member of the Minerals Separation staff. In his paper Mr. Hebbard refers repeatedly to "air-bally" material. This remained in close contact with the table in company with the sand but floated immediately under the influence of puffs of air. He refers all through his paper to this material as "granulated", doing so, apparently, in order to give the impression, which is erroneous, that the Cattermole process was still in use, whereas this "air-bally" material had no resemblance whatever to the Cattermole 'granules'. The reader is referred to Mr. Hebbard's paper. If he will read it carefully, he will, we think, corroborate our inference that the froth process was in experimental use in the Central mill long before the supposititious discovery made by Mr. Higgins, on the suggestion from Mr. Ballot, in London in March 1905.—EDITOR.]

Flotation in Stages

The Editor:

Sir—Referring to the article by W. H. Coghill under the above title, published in your issue of September 20, and the discussion of Mr. Ernest Gayford in the issue of October 18, a few observations of my own may be offered as of possible use.

The experience of the Lower California Metals Co. of Nogales in regard to the flotation of molybdenite was the same as that of Mr. Coghill. I was persuaded at the time, however, that this was to be attributed to the exceptional character of molybdenite, and should not be expected of most other minerals.

Even when not finely crushed, molybdenite breaks into very thin flakes; and when the ore is finely crushed, these are excessively thin. The molybdenite flake lies with its greatest extensions in the plane of a bubble-surface, and as apparently a primary bubble-surface can only accommodate one flake in thickness, it requires a large flotation capacity to get a reasonable extraction of molybdenite.

With other minerals I have seen bubbles in the last cells that had visible spaces between the grains of mineral. With molybdenite I never had enough flotation machines to see any such space. Probably it is not practicable to carry the concentration of molybdenite to such a degree of perfection because the final concentrate is required to be of exceptional purity, as compared with the concentrates of other minerals, and most of the flakes that are pure enough are collected in the first cells. Cleaning the concentrate obtained from further cells seems to be rather a thankless job.

The amorphous molybdenite, such as the Duquesne mine produced, could hardly be made into a marketable product at all. It is natural to suppose that the smaller the particles of mineral the greater the difficulty of crushing them fine enough to free them from gangue. This is apart from the additional trouble of cleaning the concentrate, especially that containing carbonate of lime and other easily pulverized materials that permeate the solution and inevitably form a portion of the bubble.

This idea of the limit of the primary bubble-surface capacity to one thickness of mineral has not, I think, been brought prominently forward before and may reasonably be expected to be questioned. It has, however, a basis of theory. Water and most other solutions disintegrate fine granular material, like clays, and swell them out because the liquid forces itself between each two contiguous grains (capillary attraction). It so forces itself because the water-solid contact tends to extension as much as possible. There are Brownian movements, but these can hardly be thought to be primary causes of the absorption of water by the material.

The particle, being floated, must have a definite relation (whatever it may be) to the surface, or surfaces, of the bubble. Within the liquid, two particles do not stay in contact, but are forced apart. Therefore, each bubble-surface can only support one flake or one surface of a particle. Anything else that is in the bubble is merely caught up by accident.

When a bubble breaks, its load is deposited on the bubbles below it and in time a single bubble may accumulate many thicknesses of particles and so have great stability. But this is accidental and in no way related to the actual process of the selection of the particles by bubble-surfaces.

The extra thicknesses might just as well be of sand or any other earthy material that might be sprinkled over the bubbles.

The fact that the effect Mr. Coghill mentions has only been noticed with molybdenite, and this in at least two very distinct cases, seems to indicate that it is hardly worth while to worry about the stage-crushing of most minerals. One great practical advantage in favor of flotation, of course, is the small number and the simplicity of the grinding and classifying appliances employed. Any improvement by floating in stages would therefore have to be very apparent and clearly economical in order to be acceptable in practice.

BLAMEY STEVENS.

Mexico City, October 29.

Mining Engineers' Fees

The Editor:

Sir—A few days ago a case was decided in a Denver court (with mining men on the jury) in which the promoter, who had engaged an engineer to go from his place of business in Colorado to another State on important work, declined to pay the bill of the engineer engaged, on

the ground that "field work" was service at the place of examination and did not include time "in transit" or spent in hotels. Professor Regis Chauvenet, past-president of the Colorado School of Mines and Forbes Rickard, both eminent mining engineers, testified for the plaintiff that "field service" was generally understood to include time absent from and returning to the regular place of business of the engineer engaged, but did not include fractions of days of the start and finish of travel or consultations with other engineers engaged by the defendant promoter in reference to the original report. Verdict for plaintiff, with full amount sued for, and costs.

A. B. Frenzel.

Denver, October 20.

A Tariff on Quicksilver

The Editor:

Sir—In your issue of October 18 there is a letter from Mr. Arthur B. Foote concerning tariff protection for metals. Mr. Foote takes the point of view of a gold miner, and it is to be hoped sincerely that his is not the point of view of the majority of gold miners, or other miners for that matter. If it is, we have the mining industry divided against itself.

If a reasonable tariff on quicksilver, chrome, and tungsten would so stimulate that part of the industry producing them that there would result a labor shortage in other parts, it would appear that the country must possess vast resources in these metals that, for some reason, are not being developed. When the resources of a country are not developing, the country is suffering an economic loss. There is no good reason why one branch of an industry should lie idle in order that another may have cheaper labor.

Everybody will not admit that a tariff always has the effect of raising prices. If properly applied, it will permit industries in this country that cannot compete with powerful industries of the same kind in foreign countries, to develop; and it is reasonable to believe that a fair percentage of them will reach a point where they can compete. Competition means reduced prices.

It seems to be regarded as an economic essential that a country should develop and have at its command all its resources. During the War the Government made frantic efforts and expended vast sums of money to force production, at a moment's notice, of latent resources which, in the case of metals and minerals, few outside the scientific bureaus at Washington knew existed.

The importance of having the quicksilver, chrome, and tungsten industries developed far outweighs any increased cost to other industries, using their products, caused by a tariff which will enable them to exist during the early stages of development. Common sense must be applied; it would be nonsense to protect an insignificant industry that could not possibly have a future. When, however, an industry depends on a natural resource, great care and some patience should be exercised. This country comprises a vast territory and we all believe that, in most instances, its latent resources vastly exceed those developed, otherwise we would be a nation of pessimists rather than the nation of optimists that we are. There seems to be a general conclusion by men outside the quicksilver industry that our supplies of ore are all but exhausted and that the industry is a declining one, deserving no consideration. Such a conclusion is without reason and unwarranted by the facts. What the industry needs now is a chance to develop. European producers are not going to give consumers in this country their metal at a slight margin above cost, but will obtain the highest price they can and at the same time keep competition out of the field. What we need is not a tariff that will give us an unreasonable price but one that will stabilize the industry by removing wide fluctuations of price and enable us to do consistent and efficient development. Inconsistent development forced by periodic high prices or by the Government in time of need is the worst thing that can happen to a mine. It results in inefficient equipment and bad work, and, in most instances, in the gutting of the deposit long before its day of natural exhaustion.

In the quicksilver industry, artificially increasing its value or rather stabilizing it at a fair price will not result in decreasing the value of ore in any other mine. This might have been so in the case of silver ores in the days of pan amalgamation but it is not so in these days of cyanidation, and it is not so in the case of gold ores. The cost of quicksilver per ounce of gold, in gold amalgamation, is insignificant. The cost of explosives per ounce of gold or silver is also insignificant, to say nothing of the effect of a slight advance in the price of blasting-caps.

E. M. Gelm.

Study Butte, Texas, October 25.

The Editor:

Sir—In response to the many articles relating to the question of a protective tariff on quicksilver and other metals of the infant industries, I would like to submit the following views, as one interested in the quicksilver industry.

The opinion seems to prevail, from various articles that I have read from time to time, that the quicksilver industry is a declining one. It is not even conceded that the known deposits could be developed without destroying all possibilities of a future in quicksilver. Many seem to think that California has all of the quicksilver deposits of the United States. Others will go so far as to state that a protective tariff on quicksilver would tend to inflate the already high prices; and that these inflated prices work a hardship on all of the industries that are required to use quicksilver or any substance containing quicksilver.

The quicksilver industry in this country cannot be a declining one, for as yet it has not had the honor of having arisen. It is commonly known as one of the infant industries, and as such is in need of development. There are considerable low-grade cinnabar deposits that could be developed if the market value of a flask (75 lb.) of

quicksilver stabilized at about $100 by a protective tariff. The experience with these deposits shows that they for the most part become richer in depth. Considerable development work then becomes necessary to learn the nature of them and prove their value. This development work must take considerable time, and thus we cannot adopt the policy of watchful waiting while the supply and demand adjust themselves pending the starting of the development work.

Up to the present time California contributes more than half the quicksilver produced in the United States. Oregon and Nevada have some few deposits that may be developed while Texas, which produces about a quarter of our quicksilver, has considerable areas of mineralized country containing quicksilver deposits. This region is generally known as the Big Bend country and for the most part lies in Brewster county. All these deposits may be developed while even others may be discovered if the market price should be stabilized at a fair price.

It is quite true that all industries depend directly or indirectly upon each other for a livelihood. One industry in itself produces a certain article that several other industries require and it in turn requires the products of several of the other industries. Thus it may be seen that the decline of one industry affects the prosperity of all the others, as well as the prosperity of the country. Why then should foreign concerns—in this case, only one foreign concern, namely, the Rothschilds, who control about 74% of the quicksilver industry of the world and manipulate the market as they wish, cracking the whip at those who are trying to develop the industry in this country—be allowed to directly control our prosperity? They are able to produce as much or as little quicksilver as they like, and thus keep the price to where it best suits their needs. They unload their product in this country only when the value goes high enough over here to give them a profit over what they could obtain in Europe. It may thus be seen that it is the producers in this country that suffer the decline only to have the same condition repeated once the price rises again. How can anyone feel here that they are benefited by the establishing of free quicksilver? No one pays for it except our own industries and we might as well keep the money at home by placing a tariff on the quicksilver, stabilizing the market, and developing our own resources.

Study Butte, Texas, October 29. J. B. HUNLEY.

Class Journalism

The Editor:

Sir—Referring to your interesting editorials on the type of editors that most of our trade and professional papers have, a recent number of 'System: The Magazine of Business' printed some suggestions of advantages that European business has over American business.

'System' pointed out that the higher officials of a European business house are apt to have their offices in quiet nooks secluded from the hurly-burly of routine friction, or perhaps have no offices at all in the ordinary sense of that term, but do their work at home. This permits more uninterrupted and careful thinking than would be possible otherwise.

The usual American trade paper sets its editor down in the middle of clerks, printers, visitors, parades, telephones, bickerings, and bluffings, and tells him to go ahead and produce thoughtful editorials and interesting articles. Naturally his efforts appear spasmodic and commonplace; his editorials read like a business letter, and his ideas lack historical perspective and judicial poise. Writing under such conditions is not much different from writing on the sidewalk of a busy street-corner. If a business-man needs quiet and leisure to collect his ideas and formulate plans, how much more does an editor need them!

As to the business-man's need of seclusion, 'System' says, speaking of the European system: "A close physical association destroys perspective . . . As one executive said to me, 'If I were near at hand, my managers would come to me with their first impressions, and I should be all day settling matters which they ought to settle themselves. They have a problem because they do not know exactly what they are talking about . . . The business of a chief executive is to think, to plan, on broad lines of policy, and one cannot have the necessary detached mind if he is being bothered with the petty affairs of the day. I make decisions, but will not bother with the machinery before or after the decision'."

As you indicate in your editorial, many of the shortcomings of our editors are the consequence of treating them like petty clerks, to be frowned at if they sit dreaming and chewing a pencil and to be hustled into "office efficiency".

P. B. MCDONALD.

New York University, November 4.

THE metallurgical industries of Belgium, taken as a whole, are in very bad condition. Large plants like those at Thy-le-Chateau, Monceau-Saint-Fiacre, Bonnehill, and Thiebaut have been totally destroyed. Others, like the Providence, Clabecq, and the greater part of the large factories in the Liege valley, have suffered serious injury; the blast-furnaces have been wholly or partly demolished, the rolling-mills destroyed, and the steel works plundered. In regard to those which were destroyed, it is impossible, even approximately, to say when they can be reconstructed or placed in working order. An effort will be made to repair those only partly plundered and to restore to usefulness the parts still standing. These factories in general will be able to resume their former activity after undergoing repairs, which, however, will take several months. Only a small number of factories have suffered slightly or not at all. These may begin work within a few months. To bring about the rehabilitation of these important industries, it will be necessary to re-establish transportation facilities, replace, as far as possible, missing apparatus and machinery, and notify the owners as to when and under what conditions they will be indemnified for their outlay. The lead factory of the Dumont Brothers Co. at Selaigneaux was almost entirely destroyed by the Germans.

FIG. 1. PLANT OF CIA. MINERA, FUNDIDORA Y AFINADORA

FIG. 2. SMELTER OF THE A. S. & R. CO.

Mining and Smelting Near Monterrey, Mexico

By R. B. BRINSMADE

INTRODUCTION. The city of Monterrey, capital of the State of Nuevo Leon, is situated at an altitude of 500 metres above sea-level and only 150 kilometres from the Rio Grande. Its low altitude gives it the climate of southern Texas rather than that of the Mexican plateau, which usually exceeds 1500 m. in elevation; and its propinquity to the border makes it the most American in appearance and population of all the large Mexican cities. Leaving the city with its well-paved streets, its handsome business blocks and residences, and its extensive smelting industry, we need go only 12 miles out of town on a narrow-gauge railway to reach the extensive lead mines of the Cia. Metalurgica Mexicana at the village of Diente.

DIENTE LEAD MINES. The railway terminal is at an elevation of 1000 m. in a valley with high, steep walls. As shown in Fig. 1, the valley represents an eroded anticline in shale, whereas the cliffs above are of hard blue limestone, which encloses the orebodies. The cliffs contain a line of vertical caves, and it was on the floor of these that the lead ore was first discovered. The largest ore-chimney yet found lay beneath the floor of the biggest cave, which was 150 m. in width and height. The crest of the cliffs is 1000 m. above the valley and the ore-chimneys evidently extend down for a long distance, as they show no signs of cutting out in the deepest workings. As is usual in this class of deposit, a series of seams and stringers runs along the ore-zone and guides the prospector from one chimney to another. The valuable mineral is silver-bearing cerussite, which changes to galena in the deeper workings, while the accesory minerals are limonite or pyrite, and calcite. The many faults and folds cause the ore-channel to cut across the beds of limestone and the mine excavations were formerly worked by square-set timbering, but this required imported Texas pine and cost five times as much as the present system of slicing under mats of timber in panels,[1] which permits the use of native wood and is fully as convenient, because these sub-vertical chimneys of soft ore are descending within firm walls of limestone. The regular output from this group of mines is 1000 tons per month using a crew of 250 men; but when in bonanza, shipments of 5000 tons per month have been made.

There are three mines, the Zaragosa, the San Pablo,

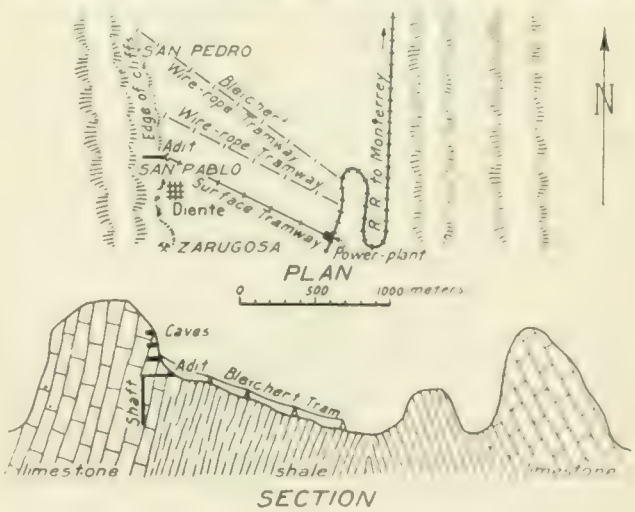


FIG. 1

and the San Pedro. The lower stopes of the San Pablo are opened by an adit (see Fig. 1) that communicates with a vertical shaft. The loaded mine-cars, which come up on the single-deck shaft-cages, are run down by gravity on an 18-in. track through the adit to its mouth. The empty cars are hauled back to the shaft by an electric hoist of Lidgerwood make and second-motion type, using a half-inch steel rope. To descend from the portal of the

[1] 'Mining without Timber', by the Author, p. 206.

adit to the railway loading-bins in the valley—distant 1000 m. horizontally and 400 m. vertically—there is a three-rail gravity surface tramway of metre gauge working with a ¾ in. steel rope.

Starting from an adit at a higher level is a wire-rope tramway, on the Hallidie single-rope system, which is now little used. A third ore-conveyor is in the form of a Bleichert wire-rope tramway, which has an inch carrier-rope of locked coil and a ⅞-in. traction-rope to cover a horizontal space of 2200 m. and a vertical height of 600 m. This last tram takes the ore from adits nearly 200 m. vertically above the main adit, which is served by the aforesaid surface tramway. To a person unused to this locality, the steep limestone cliffs, rising dizzily above the tramway terminals, and the sheer drops of the rope-ways themselves appear more suitable for a birdman than for a conventional miner.

Power for the mining machinery is furnished by two Fraser & Chalmers return tubular coal-fired boilers, 5 ft. diam. by 18 ft. long, with 52 four-inch tubes. These supply steam to a Fraser & Chalmers horizontal compound Corliss engine with 24-in. stroke and low-pressure cylinder of 24-in. diam. This engine turns two Bullock dynamos, which furnish direct current at 500 volts for running the electric motors in the mines above. The steam-power plant is on the level of the railway to Monterrey and close to the foot of the Bleichert tramway. Near the mine-office in the village of Diente, on the west edge of the valley, is the air-compressor plant, run by electricity and sending its output through a 6-in. welded pipe to the adit and into the mines.

Drilling for development and stoping is done mostly by air-hammer drills. The repair-shops are placed on the level of the adit and are run by electric motors. In 1910 the mines were flooded by four days of steady rain, and this caved many of the winzes. Since then it has been necessary to use artificial ventilation in the deeper stopes in the form of electric fans. Normally, the vertical bedding-planes of the limestone drain off the scanty rainfall so that no pumping is needed to keep the workings dry.

Smelter No. 3 of the A. S. & R. Co. Returning to Monterrey we may now visit the lead smelter, No. 3, of the American Smelting & Refining Co. This plant (Fig. 2) has a nominal capacity of 460,000 tons annually; it is on a site of 300 acres and has 10 blast-furnaces. These are all 12 ft. long by 44 in. at the tuyeres, of which there are eight of 3½-in. diam. on each side. There are four flanged-steel water-jackets on each side and one at each end, while the smelting charge is enclosed by a rectangular brick tube extending to the feed-floor and resting on the usual I-beam girders and cast-iron posts.

The lead is ladled from an Arents siphon-tap but the slag has to pass two settlers before reaching the Nasmyth slag-car, which is hauled by a light steam-locomotive to the slag-dump. The first settler is a brick-lined rectangular steel tank and needs changing several times each year; the second settler takes the overflow slag from the first and consists of a specially lined Nasmyth pot, which is changed every 12 hours. Matte and lead are tapped intermittently from spouts at the bottom of both settlers. The matte seldom exceeds 10% of the charge, as the sulphur is kept below 4%; it is taken in small pots to the matte-rolls to be reduced to ¼ in. diam. and roasted, in reverberatories (rabbled by hand) for return to the blast-furnace as an iron flux.

The blast-furnaces are set side by side and are fed mechanically[2] by a charging-car, which is hauled by an electric third-rail system motor over their tops and is emptied into a hopper beneath the rails on the feed-floor of each furnace. This hopper extends over half the length of the furnace, the width of the charging-car being about the length of the hopper, so that the latter can be evenly filled throughout from the drop-bottom of the former, which is hoppered crosswise the car's length. The furnace-hopper's bottom can be dumped by a lever on the feed-floor onto a central longitudinal spreader of 'A' section. For filling the charging-car, there is a mixing-hopper beneath the ore-bedding floor into which the different ingredients, brought by barrows from the ore-beds and fuel-bins, are dumped. The charging-car runs under this mixing-hopper, which just fills it, so that the car can then be run to a hydraulic elevator and raised to the level of the blast-furnace feed-floor.

The charge is carried from 18 to 23 ft. vertically above the tuyeres, according to the increase in silica.[3] The more silica in the slag, the higher the charge and the heavier the blast-pressure, which may reach 40 oz. per square inch. It is generated by Connersville cycloidal blowers turned by tandem-compound horizontal Corliss engines. A common slag used runs 31% SiO_2, 22% CaO, and 35% FeO. The lead-fall varies from 8 to 12%, while the consumption of coke is around 12½%.

The blast-furnace smoke descends in a down-comer pipe debouching beneath the feed-floor into a brick settling-chamber of large cross-section; this discharges into a centrifugal blower of some 12 ft. diam. driven by a simple horizontal Corliss engine. The fan forces the smoke through a long cooling-flue into a brick bag-house provided with cotton bags, which are shaken mechanically, at intervals, into steel hoppers whose contents can be dropped into cars for transport to the fume-storehouse. Later the fume is briquetted with fine ore in a Chisholm-Boyd & White press and returned to the blast-furnaces.

For sampling, there is a separate building containing two duplicate sets of machinery, each comprising a jaw-breaker, coarse rolls, a Vezin automatic sampler (No. 1), fine rolls, and finally two Vezin samplers (No. 2) set in parallel. The rich custom ores are first sampled, in 2500-lb. lots, by-passing through the first sampling outfit and getting two 100-lb. samples from each of the Vezin No. 2 machines. The rejects are then put again through the duplicate outfit, from the Vezin No. 1 onward, in order to get two more duplicate samples. All four samples are

[2] 'Mechanical Feeding of Silver-Lead Blast-Furnaces,' by A. S. Dwight, A. I. M. E., Vol. XXXII, p. 353.

[3] 'Metallurgy of Lead', by Henry F. Collins, chapter on 'Blast-Furnace Smelting'.

then cut down, by hand-quartering and splitting, before being sent to the assay office, where a separate analysis is made of each. This extreme duplication costs something to achieve, but it has been found profitable.

The ore-beds are formed on a flat floor at the level of the incoming railway-tracks. They are bounded on the track side by movable loose-plank doors that can be raised gradually as the beds get higher till the level of the box-car floors is reached. The unloading is done by wheelbarrows.

The roasting of the sulphide ores is divided between old-fashioned hand-rabbled reverberatories and the Dwight-Lloyd machine. Of the former there are about a score, each with a single hearth 16 ft. wide by 50 ft. long inside. They roast to a sinter, using soft coal as fuel; petroleum was tried, but was found to heat too unequally. Each furnace handles 18 to 20 tons in 24 hours, with the labor of one attendant per shift. He shoves the charge along the hearth with the aid of a Robinson rabbler. This device consists of two shafts sliding back and forth horizontally below the furnace-doors on the exterior of the hearth, one on each side; a small steam-engine is set between each pair of furnaces and reciprocates the two shafts immediately adjoining. To the moving shafts are attached two vertical bars at each furnace-door; they act as impellers for the rabble, with the aid of the door-frame as a fulcrum. This invention has cut the roasting force in two, and makes the work easier.

The Dwight-Lloyd roasting machine is too well known to need detailed description. As used here, it consists of an endless belt, some 30 ft. between centres and formed of cast-iron herring-bone grate-bars, with side rims to keep the charge from falling off, and supported on each side, between the end pulleys, by a track, which is run on rollers set on the end of each grate-bar. Falling from the hopper onto one end of the belt, the charge passes under an ignition flame at once, and is kept burning until it reaches the discharge end of the belt, where it falls off into a hopper, in a lumpy sintered condition ready for the blast-furnace, and thence can be spouted to a car below running to the ore-beds. The draft is maintained at 10 in. of water by a Sirocco fan whose intake is set under the endless belt and which blows the smoke up a stack. The charge for roasting must be ground to 20-mesh and moistened with water in a revolving helical mixer: it is then fed automatically onto the belt in a layer 2 to 2½ in. thick. The belt-grates are protected against the corrosive action of the roasting gases by a ½-in. layer of limestone, crushed to ½ inch and fed onto the belt in advance of the ore-feed. The latter can contain up to 40% lead, but beyond that it must be diluted with some inert mineral to prevent stickiness. The capacity of the machine is 18 to 20 tons of sulphide ore or concentrate in 24 hours.

The final product of this plant is base bullion (work lead) rich in silver, of which the bulk is shipped to the company's refineries in the United States.

Plant of the Cia. Minera, Fundidora y Afinadora.

This consists of a smelter and lead-silver refinery (Fig. 3) near Monterrey. The refining is the main business here, and the smelting operations are therefore small as compared with the A. S. & R. plant. There are nine full-size and one smaller blast-furnace. The former can smelt 90 tons of charge per day using around 15% of coke and a lead fall of 10 to 12%. A common slag is SiO 34%, FeO 26%, and CaO 23%, the matte-fall being kept under 5%. The blast pressure is 24 oz. per square inch and is maintained by one large and one small Connersville cycloidal blower each direct-connected to a simple Corliss horizontal engine. The furnaces are fed by hand through vertical side-doors above the feed-floor and carry a 15-ft. smelting column above the tuyeres, which number six of 3½ diam. on each side. There are only four flanged-steel water-jackets to surround a rectangular hearth 10 ft. long by 3½ wide; as these jackets are only 4 ft. high the smelting column has to be kept of moderate height in order to prevent cutting out the brick lining above the jackets. The slag is tapped intermittently directly from the furnace into a conical settling-pot, which, before pouring into a Nasmyth slag-car for haulage to the dump, is partly cooled and settled. The matte is crushed, roasted, and then smelted in one of the blast-furnaces operated for producing a copper matte for shipment. The shells of the settling-pot are broken up and returned to the ore-charge of the blast-furnace.

The roasting is done mostly in 16 by 50-ft. single-hearth reverberatory furnaces, which are rabbled by the old type of unaided hand-hoes, yielding a sintered product. There is also a Pearce single-deck rotary roasting-hearth, which gives better satisfaction than the hand-furnaces. The fuel for all roasters is Mexican crude petroleum.

The sampling here is unworthy of special notice, as it is done by the usual hand-methods of split-shoveling and quartering by coning.

The refinery buys base bullion and cyanide-mill precipitates, and delivers pure and hard-lead silver and gold to the metal market. The base bullion is handled by furnaces set on three terraces; the upper terrace has three liquating reverberatories, the middle one has two lead-kettles, and the lowest has five refining reverberatories, of which two are for the base-bullion system, one for leaching mill-precipitates, and one for antimonial lead and other by-products.

The liquating-furnace melts the base bullion slowly and forms, first, a copper scum that is returned to the blast-furnace. The second scum to rise is chiefly antimony and arsenic, and is worked off the bath by the aid of rich litharge from the cupel-furnace and an air-blast. The arsenic is mostly volatilized during skimming, leaving an antimonial product, which is liquated again separately to yield base bullion and an antimonial scum that is run intermittently into the small blast-furnace, in order to get hard lead containing from 16 to 20% of antimony.

The lead-bath of the liquating-furnace after two skimmings is spouted down to the lead-kettle for de-

silver-lead by the Parkes process.[4] After first removing a coppery scum, enough spelter is stirred into the bath to take up the silver present. The foreman cupels a sample from the bath to ascertain the silver content. The zinc scum, containing the silver, the gold, and the residual antimony from liquation, is now skimmed and thrown into a press, where it is squeezed dry of lead. This press is worked by compressed air and is lowered over any kettle by means of a traveling crane. The pressed zinc-scum is now carried to the usual Faber du Faure retort-furnace for distilling the zinc from the rich silver-lead residue, which goes to the cupeling-hearth. The latter is started by one charge of rich silver-lead, but is not finished until many similar charges have been added, so that the resulting silver-gold button shall be of considerable size.

The de-silverized lead of the zinking kettle is meanwhile piped by siphon down to the refining-furnace, where it is freed from its residual zinc and antimony by the usual process of volatilization at a high heat combined with slagging in an oxidizing atmosphere by means of litharge created as a scum in the molten bath of lead on the hearth. The bath is skimmed several times for its lead-zinc scum until the remaining scum shows large thin plates of a yellow color quite free from the brown spots of antimony.

While the Parkes process at this plant contains nothing unusual—in fact, such innovations as the use of the water-hose to hasten the work of the zinking kettle seem to be unknown—the Moebius process in the silver refinery presents novel features designed by the local staff. The parting machine (Fig. 4) consists of sheet-silver endless belts, *C*, set 3 high and longitudinally in the electrolytic-vat *V*, which acts as 48 movable cathodes. The anodes, *A*, are plates 12 by 3 by ½ in.; they are cast when ladling off the silver-gold button of the cupel-furnace, and are set in wooden trays, *T*, that have woven-wire covers and checker-work bottoms lined with cloth. The electrolyte filling the vat is a solution of silver nitrate in nitric acid drawn from the porcelain pots used in the boiling of the gold. As the belts make only two revolutions per hour, the silver has a good chance to deposit on them in crystals. The latter adhere so loosely to the greased surface of the sheet-silver that they can be easily scraped off, by mechanically-moved bristle-brushes, into hoppers that spout them out of the vat, whence they can proceed to the melting-furnace and be cast into fine silver ingots for the market. The gold remains as slime on the cloth bottoms of the anode-trays, and is thence taken to porcelain pots, where it is first boiled in nitric and finally in sulphuric acid before casting into bars for shipment. The voltage of this Moebius vat is 100, giving two volts for each of the 48 belts set in series, while the amperage is 250 and the capacity one metric ton per 24 hours.

THE MONTERREY STEEL WORKS. This is really the only complete works for making soft steel direct from the ore in the whole republic of Mexico. It was built some 20 years ago. As a detailed description of this plant was published soon after its inception[5], I will not do more here than mention certain economic problems connected with its operation and the Mexican iron industry.

At the time of my visit, the single large blast-furnace was producing 225 tons of pig-iron daily, or sufficient to supply the requirements of the steel furnaces. These now operate by the half and half process, as a set of Bessemer converters has been added to the open-hearth furnaces of the original plant. The blast-furnace is equipped with a skip for automatic feeding, and taps its slag into slag-cars for the dump and its metal into other cars to go direct to the converters. At the start this furnace was intended to utilize only coke and ore from the near-by deposits, but for many years past this policy has been abandoned. The Coahuila coal not only produces coke

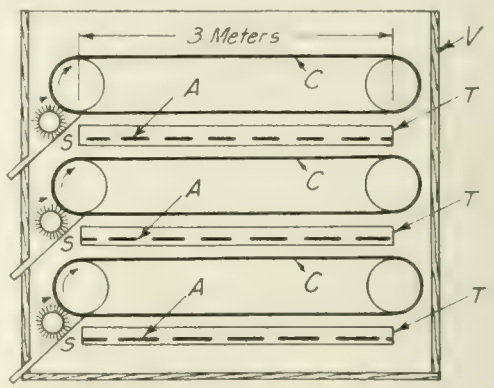


FIG. 4. PARTING MACHINE FOR THE MOEBIUS PROCESS

with some 20% of ash, but this ash is so aluminous as to yield a sticky slag, and causes a consequent heavy loss of shots of metal if used alone. By mixing this coke with a third of foreign coke the loss is reduced, but the American foreman estimated that he could easily increase to 500 tons the furnace's maximum output of 350 tons if he could use Connellsville coke and Lake Superior ore instead of the present charge. At first thought the alumina in coke would seem no more harmful in the furnace than that of the ore or flux, but the difference in its action is considerable. This is because the alumina of the latter materials can combine into slag some distance above the tuyeres, near the top of the zone of high temperature, and descend harmlessly as a liquid to the slag-bath below. The alumina of the coke, on the contrary, is not set free until its carbon matrix is quite consumed, an event that does not occur until the coke reaches the zone of combustion, just above the tuyeres, where the plentiful shots of just reduced metal are easily ensnared and held by the sticky aluminous ash.

The great expectations for the ore deposits of the company, near Golondrina, Nuevo Leon, were disappointed after a few years of production. Showing large outcrops of high-grade hematites and magnetites of Bessemer quality, these orebodies, like many others of the contact type, became so pyritic in depth that their use had to be

[4]'The Metallurgy of Lead', by H. O. Hofman.

[5]'Steel Plant at Monterrey, Mexico', by William White, Jr., A. I. M. E., Vol. XXXII, p. 344.

[illegible] a fraction of the ore charge. Fortunately for the enterprise, a huge deposit of rich ore exists in the Cerro de Mercado of Durango City, and for over a decade this 'iron mountain' has been the main source of supply for the steel works, despite the fact that the transport involves a rail haul of 646 km. In view of these facts, some might prefer Torreon to Monterrey as a site, had the steel works to be re-located. Torreon is only 253 km. from Durango City and but 160 km. farther than Monterrey from the Coahuila coalfield. For the transportation of the finished products—rails, shapes, bar-iron, and castings—the two sites are equally advantageous, both being some 1000 km. away from the centre of consumption and population near Mexico City. Others might go even further than change the site and question the wisdom of maintaining such a steel works at all, when it has available neither the accessible raw material nor the proper quality of labor to enable it to undersell the imported steel, and must therefore be subsidized by a protective tariff at the expense of the great natural metal industries of Mexico—those of silver, gold, lead, and copper.

Mining in Montana in 1919

The metal output of Montana declined notably after the war demands for metals ceased. The period of transition from war to peace was one of curtailed production and lower prices for copper, lead, and zinc. Production from the mines at Butte, the source of most of the State's output, was reduced during the first half of 1919 to nearly half that of the first half of 1918. Several of the large copper mines were closed, and the smelters at Anaconda, Butte, and Great Falls were operated on a greatly reduced scale. Though production was low at the Washoe smelter at Anaconda, the plant was being improved, the new stack and Cottrell treaters having been completed and connected with the furnaces. This new equipment will afford a large output of arsenic.

Gold. The gold produced in Montana in 1918 was valued at $3,104,764, a decided decrease from the output of 1917. The placer gold produced by dredges in Madison county is falling off rapidly, and even the gold obtained from dry or silicious ores is decreasing in Lewis and Clark, Phillips, Fergus, and Deer Lodge counties. The gold produced from the ores of Butte increased in 1918, on account of the large output of copper ore and the activity of the zinc leaching plant at Great Falls, but there will be a marked decrease in 1919 because of the reduction in the output of copper ore. During the first quarter of 1919 the Barnes-King Development Co. received $189,060 for ore milled at the Shannon, Piegan Gloster, and North Moccasin mines. The two mines last named were operated at a loss, but the ore from the Shannon mine was sufficiently valuable to pay expenses and dividends.

Silver. The output of silver from Montana in 1918 was 16,797,479 oz., valued at $1 per ounce, or nearly $6,000,000 more than the output of 1917. This is the largest output of silver recorded for the State, and is larger than that of any other State, but the rate will not be upheld in 1919, even though the price of the metal has improved, because of the declining output of the ores of the base metals from which the silver is derived. Nearly 90% of the silver produced in Montana in 1918 came from Silver Bow county.

Copper. The output of copper in 1918 was 323,174,850 lb., valued at $79,824,188. Several years ago Montana was the largest producer of copper in the United States, but in 1918 Arizona produced more than twice the quantity given above. The shipments of copper ore and bullion for the first five months of 1919 indicate an average production of about 15,300,000 lb. of copper per month, as against an average of nearly 27,000,000 lb. per month in 1918. Several of the large mines of the Anaconda Copper Mining Co., such as the Original, Leonard, and Pennsylvania, were closed early in the year, and the production of the North Butte was reduced by more than 50%. At the Pittsmont smelter only one copper furnace was active in the latter part of March.

Lead. The output of lead from Montana was 37,135,875 lb. in 1918, a notable increase over the 21,951,220 lb. produced in 1917. Much of the lead produced in 1918 came from Jefferson and Lincoln counties, but most of it came from the Anaconda properties, Butte & Superior, Emma, and Elm Orlu mines at Butte. Much lead-zinc ore has been opened at the Emma mine and at properties in the western part of Butte, and shipments continue from the main producers, but there will undoubtedly be a decided decrease in production in 1919. Shipments of lead bullion from the East Helena plant were upheld, but most of the ore that is sent to this plant is produced in Idaho. A large quantity of lead ore is being shipped from the Angelica mine, in Jefferson county.

Zinc. The production of zinc in Montana in the first half of 1919 has been somewhat reduced, but not so much as in some other Western States. The output of zinc in 1918 was 209,258,148 lb., valued at $19,042,491, or 9.1c. per lb. Most of it came from the mines at Butte—Butte & Superior, Elm Orlu, Emma, and several mines at Anacona—and nearly all the remainder came from the Snow Storm mine at Troy, and the Pilgrim property, at Basin. All these mines were active in 1919, and the electrolytic zinc plant at Great Falls continued to turn out spelter of high grade, though the total output was somewhat less than in 1918, when an average of about 6,000,000 lb. of zinc was shipped each month. During the first quarter of 1919 the Butte & Superior mine produced about 7,000,000 lb. of gross zinc per month, against 11,500,000 lb. per month in 1918. The decrease was due to the Anaconda company's refusal to take custom zinc ore in the first months of 1919. The later shipments were about 80% of normal.

Dividends were paid by the Anaconda Copper Mining Co. and the Barnes-King Development Co. in the early part of 1919.—C. N. Gerry, U. S. Geological Survey.

[6]'Iron Mountain, and the Plant of the Mexican National Iron & Steel Co., Durango, Mexico', by T. F. Witherbee, A. I. M. E., Vol. XXXII, p. 156.

The Fundamental Principles of Safeguarding

By SYDNEY J. WILLIAMS

"If you want your plant to be 100% safe, it is necessary to guard every moving part, wherever located, on which a workman might be injured if he came in contact with it in any way or from any cause whatsoever. If the moving part is in a place 'where nobody ever goes', remember that some one is likely to go there sooner or later in connection with the repair or maintenance or alteration of the machinery itself or of the building, or for some other reason that you cannot anticipate. You probably have heard the story—perfectly true—of the man whose heel was cut off by an unguarded gear 14 in. below the ceiling. The man was standing on a scaffold, working on another shaft near-by; to brace himself he placed his foot against the shaft on which the unguarded gear was located, his foot slipped, and was caught in the gear. Many similar examples could be quoted of accidents occurring in out-of-the-way places. Recognizing this fact, the Illinois Steel Co. rule-book, to mention ony one example, requires that all gears, wherever situated, must be enclosed.

You may be puzzled by attempting to apply this principle to the guarding of overhead shafting and belts. Many shafts contain miles of overhead shafting which it is almost a physical impossibility to guard. On the other hand, oilers and repairmen are frequently injured, sometimes fatally, on unguarded overhead shafting or belts. The only solution is, if the shafting positively cannot be guarded, to prohibit absolutely any work on such overhead transmission while it is in motion. Shortening of belts and other repair work, as well as oiling, can be done during the noon hour or at night; or, better still, install automatic oilers or oilers that can be filled from the floor by using a special oil-can with long spout. For details, see the National Safety Council's Safe Practices pamphlet on this subject.

A gear or belt or other dangerous moving part which happens to be placed below a table, or in some other place where it is partly hidden, is not thereby made safe. Someone occasionally must reach under the table to sweep or repair the floor or oil or repair the machine. Someone may slip or stumble so that his arm comes in contact with a gear or belt which would be safe for the workman standing in his normal position. The immigrant totally ignorant of machinery—and it is hard for us to realize the completeness of the ignorance on this subject, on the part of foreigners brought up in farming districts—may deliberately put his hand or his finger into an opening that looks interesting, just to see what it is. If he finds that 'it' is an unguarded gear, it is easy to say that the accident is his own fault, but that does not relieve our obligation to pay his compensation nor does it restore him to his vacant place in the gang.

What I have said of gears and belts applies equally well to any moving part on which a man might be injured: counterweights, cranks, reciprocating parts such as a planer-bed, and so on; also, of course, to the operating point of machines.

Here are a few points to remember:

(1) A safeguard should be so designed and constructed that it will prevent accidents on the part guarded: not accidents to the operator while at his regular work, but also to the operator or passers-by in case they slip or fall or carelessly touch the machine while it is in motion.

(2) The guard should not interfere with production. If it does, it is liable to be taken off. In designing a guard it is generally wise to consult the man who will use it.

(3) In general, the guard should be attached to the machine and not to the floor; if attached to the floor, use a connection that will interfere as little as possible.

(4) The guarded part must be easily accessible for oiling, inspection, and repair. The door or removable section provided for this purpose should be hinged or otherwise attached to the remainder of the guard, or to the machine. If not, it is likely to be left off permanently.

(5) The guard should not interfere with cleaning and sweeping around the machine. It should, therefore, be kept generally about six inches above the floor.

(6) The guard should be strong enough to resist injury and keep its shape. A light flimsy guard soon becomes bent and is discarded. A substantial guard is cheaper in the end.

(7) Incombustible guards are preferred. Wooden guards, soaked with oil, may become a serious fire-hazard. Metal guards are neater and wear much better. "Metal guards look as if you wanted to; wooden guards look as if you had to." Guards may be made of cast-iron, sheet-metal, wire-mesh, expanded or perforated metal, or slats. However, where subjected to acid or fumes, wooden guards may be necessary.

(8) It is desirable to interlock the guard with the operating machines, where possible, so the machine cannot be operated unless the guard is in place.

(9) A safeguard can often be so designed that it will also serve to prevent wear on the parts guarded, for example, a solid gear enclosure.

Let us consider the application of these suggestions to the design of gear-guards. Cast-iron guards are preferred because they may be made to fit more snugly, pre-

*Secretary and chief engineer, the National Safety Council, Chicago, presented at the eighth annual Safety Congress at Cleveland on October 2, 1919.

sent a better appearance, and protect the gears from dust and injury. In shops having similar gears on several machines, the cost of patterns and cast iron guards will be no greater than the cost of 'built up' guards. A cast guard of one machine may be used as a pattern for making guards for similar machines.

Guards for a variety of machine, and in many sizes, may be more cheaply made of sheet metal. In large guards, an angle-iron is used to make the joint between the flat sides and the curved part of the guard. In smaller guards this joint may be made by cutting projections, like saw-teeth, on each side piece and bending those over to form a smooth curve. The joint may then be made either by spot-welding or by riveting. Short pieces of angle-iron may also be used to form the joint —about ¾ by ¾ by ¼ in. angles, one inch long, 3 or 4 inches apart.

Gears should be completely encased; or, where this is impracticable, should have a band-guard with side flanges extending inward beyond the root of the teeth. If there is a spoke-hazard, the gear should be completely enclosed, or filled in between the spokes.

Bolts, fly-wheels, shafting, and large gears are often guarded by an open-work rather than a solid enclosure. Such guards should be so designed that no one can get his hand or his finger into the danger-point even if he tries. If the guard comes within four inches of any danger-point the opening should not be greater than half an inch square, which is small enough to exclude fingers. If more than four inches away, which is about the maximum length of a man's finger, the openings may be larger than half an inch, but not larger than two inches square, which is small enough to keep out a man's hand. If a slatted construction is used the slats should not be more than one inch apart.

The safety engineer's greatest difficulty is in guarding machines on which men are working. Let me repeat that it is very important not to attempt to guard machines in a way that will interfere with production. The great majority of both foremen and workmen will object seriously to such a guard, will use it under protest, and when the opportunity arises they will take it off and not put it back. I have time to mention only two examples: the circular saw and the punch-press.

A guard is not the only essential for safety in operating a circular saw. For ripping, it is important that the saw be provided with a splitter. Keeping the saw sharp and properly set will greatly decrease the danger of throwbacks. The floor where the operator stands should have a nonslip surface. Many shop-men say that it is impossible to guard a circular saw without interfering seriously with operation. The safety rule-book of a large company contains a similar statement. In a great majority of the wood-working shops that I have visited, some, at least, of the saws have not been guarded or some of the guards have not been in use. I remember, however, two wood-working shops where every saw was guarded and every guard was in use: the Westinghouse Electric & Manufacturing Co., at Pittsburgh, and the Commonwealth Steel Co. at Granite City. There doubtless are others but I do not happen to have seen them. In each of these two shops every circular saw was provided with a guard that completely covered it when not in use and which rose automatically from the table as the stock was inserted. I watched men operating these saws and the guards did not seem to introduce the slightest difficulty. They were of light construction and when the stock was shoved in they rose without apparent effort, the larger ones, at least, being counterweighted. The men in charge of these departments told me that the guards did not interfere at all with production, in fact that the men now would not work without them because they felt that they were so much safer. I do not blame the workman or the foreman who objects to using a cumbersome, heavy, non-adjustable guard.

Special work on circular saws sometimes is difficult to guard. In some cases, these difficulties may be overcome by careful study. In a few cases they probably can not, and the guard must be temporarily laid aside, being hinged or pivoted for that purpose. Where this must be done, another safeguard can often be introduced. For example, in grooving the edge of a board, provide an auxiliary guide or fence, so that there will be a guard on each side of the saw, thus keeping hands away from contact with it.

The punch-press, using that common term to include all kinds of power presses, has, with the circular saw, the doubtful honor of causing more injuries, and especially more permanent injuries, than any other kind of machine. Where possible, the best guard is an enclosure around the plunger, which makes it impossible to get one's fingers underneath. Often, however, this is impossible. In such a case, let me suggest that instead of buying a dozen or a hundred of some so-called safety device, and putting it on every punch-press in the shop, you start with one individual press and study the operation carefully in co-operation with the superintendent, foreman, master mechanic, and operator of the machine. Ask yourself why accidents happen or why they may happen on the particular press you are studying. The answer will be that, for one reason or another, the operator finds it necessary or convenient to put his hand under the plunger, either regularly or occasionally. The way to make the operation safe, then, is to arrange it so that the operator need not and will not put his hand under the plunger. Sometimes this may be done by cutting away a portion of the dies so that the operator can keep hold of a part of the piece being formed and still not be injurel. Often it may be accomplished by introducing an automatic or a foot-operated kick-out. This almost always increases production as well as safety. Sometimes it is found practicable and advantageous to interchange the upper and lower dies. Sometimes the method of operation may be altered; I have in mind one case where, in riveting the handle-socket onto a kettle, the operator laid the rivets in position after the kettle was in the machine and sometimes the plunger came down and caught her finger. After a good deal of study the superintendent arranged to have another girl place the rivets in position and hand the kettle to the oper-

ever, who then placed it in the press and completed the operation, obviously without danger and obviously with a great saving in time as well. In a great many cases, where the same operation is continued for a long time on one press, it will be found economical to provide some sort of automatic or semi-automatic feed; this also always increases production as well as removing the hazard. Gate-guards and two-handed operations are sometimes necessary, but should be used only as a last resort. The methods above are more efficient because they go to the root of the matter and remove the hazard rather than merely guarding it. When you remove the hazard you simplify the operation and therefore increase production. When you merely guard the hazard you may decrease production.

What I have said of the punch-press is typical of many machines. Safety engineering does not consist in simply building wire mesh-guards, nor in buying safety devices that look pretty in a catalogue, and putting them on the machine without regard to the wishes, the convenience, or the efficiency of the operator. The real safety engineer will, where necessary, study the operation of a machine until he understands it as well or better than the operator himself; as well as the foreman, the superintendent, the master mechanic; and then he will apply their brains and his own in working out either a guard, or a change in the machine, or a change in the operation, which will remove the underlying hazard and make the operation intrinsically safe.

FIGURES COMPILED by C. E. Siebenthal, of the U. S. Geological Survey, from reports submitted by all zinc smelters which operated during the first six months of 1919, show that the production of zinc from domestic ore in that period was 247,584 short tons and from foreign ore 7918 tons, a total production of 255,502 tons, as compared with 260,664 tons in the last half of 1918 and 257,263 tons in the first half. The stock of zinc held at smelters on January 1, 1919, was 41,241 tons and on June 30 it was 59,651 tons, an increase of 18,410 tons. The stock on June 30, 1918, was 44,502 tons. The stock of zinc held by the War Department on May 29, 1919, was reported as 39,000 tons, 9000 tons of which was held at producers' plants and the remainder at plants which had been engaged in making munitions. In July the Government stocks were reported as 21,000 tons of grade A and 5000 tons of all other grades. The latest invoice by the War Department, August 30, shows 10,821 tons of slab zinc and 66 tons of sheet zinc. The decrease in Government stocks was due in part to the purchase of Government holdings of their own brands of high-grade spelter by the larger producers. From the foregoing figures and the records of the Bureau of Foreign and Domestic Commerce it is calculated that the apparent consumption for the period was 159,501 tons, as compared with 212,660 tons in the last half of 1918 and 211,870 tons in the first half. In addition to the zinc produced from ore, 7328 tons was re-distilled from zinc ashes, skimmings, and drosses. Much of this was of good grade.

Comparison of Labor and Other Costs for Five Years

Alaska United Gold Mining Company

	1915	1916	1917	1918	1919
	$	$	$	$	$
Average daily pay of all employees, surface and underground	3.46	3.44	3.76	4.44	4.71
Maximum base wage	5.00	5.00	5.00*	5.50*	5.50
				5.00	
Minimum base wage	3.00	3.00	3.00*	3.50*	3.50
				3.00	
Average of all expenditures per employee per day	6.44	8.01	12.18	10.78	12.74
Charge per month for board and lodging	29.00	29.00	29.00	29.00	31.50
				31.50	

*Base increased during the year.

Alaska Juneau Gold Mining Company

	1915	1916	1917	1918	1919
	$	$	$	$	$
Average daily pay of all employees, surface and underground	3.51	3.82	4.14	4.58	5.05
Maximum base wage	5.00	5.00	5.00	5.00*	6.00
				6.00	
Minimum base wage	3.00	3.00	3.00	3.00*	3.50
				3.50	
Average cost of all Juneau expenditures per employee per day	5.00	10.80	10.59	12.77	11.00
Average per month for board and lodging	32.00	32.00	32.00	32.00	32.00

*Base increased during the year.

NOTE: For the year 1914 the corresponding costs for the Alaska Treadwell G. M. Co. were: Average daily pay, $3.51; maximum base, $5; minimum base, $3; average expenditures per employee per day, $4.80; board and lodging, $29 per month.

Short Cuts in Mine Surveying I

By DOUGLAS WATERMAN

Preface. The aim of these articles is to furnish a few practical notes on the choice and use of surveying instruments, and to point out how many of the problems which arise in every-day practice may be treated in a simple yet satisfactory manner.

Unnecessary refinements in engineering are a waste of time and therefore of money. The choice of the method to employ in obtaining desired information should be governed by the importance of the work. The shortest way is the best provided the results are within the allowable degree of accuracy.

The theory of surveying is fully covered by the many text-books on the subject, but there are short cuts in actual practice that the engineer learns either for himself or under the guidance of an experienced chief. The methods herein described were acquired in just that way, and it is hoped that they will be of help to others.

The Compass. A Brunton compass is the simplest; it is one of the most useful of all surveying instruments. It is indispensable to the mining engineer whose work more often calls for rapid, rather than precise, surveying. When the use of the compass is thoroughly understood, one grows more and more accustomed to rely on this simple instrument for directing the course of development work and minor connections, for surveying large stopes and excavations, and for securing such data as the dip and strike of faults and other geological features in the mine, and in topographical and reconnaisance surveys, in which magnetic bearings are usually all that is required.

The Transit. For general surveying the lighter type of transit is recommended. The larger and heavier transits, owing to their rigidity, the power of the telescope, and the size of the graduated plate, are undoubtedly superior instruments where extreme accuracy is required, but for all-around work the lighter transit will be found a more serviceable instrument. It weighs only a few pounds and is compact when fitted in its case. Strapped on the back it can be carried into any part of the mine no matter how difficult of access. Surveys in the field that require the instrument to be carried long distances in the day may be accomplished without excessive fatigue.

The workmanship on these instruments is as perfect as on those of larger size. The plate is accurately graduated, and although it is difficult to read the vernier with the naked eye, it can be clearly distinguished with the aid of a reading-glass. In the field the lower power of the telescope will require shorter sights and more frequent set-ups, but this is more than compensated by the ease with which the instrument can be handled.

Standard instruments usually combine every desirable feature, but when ordering a transit it would be well to specify the following details and accessories.

1. Horizontal Circle: Preferably a 4-in. plate, graduated on silver, with two rows of figures—0° to 360°—reading in opposite directions, and a double vernier reading to minutes.

2. Vertical Circle: This should also be graduated on silver and provided with a double vernier reading to minutes.

3. Telescope: Many engineers prefer an erecting telescope, but it should be specified whether an erecting or an inverting telescope is desired.

4. Stadia-wires: These are usually fixed in the ratio of 1:100.

5. Punch-mark: The telescope should be provided with a punch-mark on top to enable the instrument to be centred from a point above.

6. Finish: The so-called 'leather' finish is preferable. This is a non-conductor of heat and affords relief to the eyes when working in bright sunlight.

7. Cover-glass: The glass cover to the needle should be cemented in place to prevent the accumulation of moisture, which may cause the needle to stick.

8. Auxiliary telescope: Required for the work of mine surveying.

9. Split extension-tripod: This is the best style, as it combines lightness and service with the maximum of rigidity.

10. Transit-case: This should be as compact and as light as possible, and provided with leather cover and shoulder-straps to facilitate transport underground.

The Level. While accurate leveling can be done with the mining transit when in perfect adjustment, there are occasions when a more precise level is required. Such an instrument will be found in the dumpy level, which is recommended on account of its simplicity, strength, compactness, and permanency of adjustment.

A hand-level will often serve in determining comparative elevations, in preliminary surveys for roads, ditches, and grade work, and in forming estimates for cut and fill.

The Philadelphia rod is an excellent pattern. It can be used both for leveling and stadia work, being self-reading up to 300 or 400 ft. It is well to have two sizes; one 7.3 ft., extending to 13 ft., and the other 3 ft. extending to 5 ft. for mine use, both provided with a target and vernier reading to 1000ths.

A rod-level is of great assistance in holding the rod in a vertical position for stadia measurements.

Before attempting any of the adjustments involving the telescopic line of sight it is necessary to bring the cross-wires into sharp focus, and at the same time to

eliminate parallax. Point the telescope to the sky and by turning the eye-piece, move it in or out until the cross-wires are sharply defined. Direct the line of sight to some distant object and focus clearly on a definite point. If, when the eye of the observer is moved slightly in any direction, the point appears to move in relation to the intersection of the cross-wires, there is still some parallax, and the eye-piece must be moved slightly until it is eliminated.

The three essential adjustments of the engineer's level are:

(*a*) Collimation adjustment.
(*b*) Bubble adjustment.
(*c*) Y adjustment.

(*a*) Having set up the instrument and corrected for parallax in the manner just described, proceed with the collimation adjustment, the purpose of which is to place the intersection of the cross-wires in the prolongation of the optical axis of the object-glass at focal distance from the lens.

Direct the telescope so that the vertical wire is tangent to the vertical profile of a building or suspended plumb-line. Turn the telescope half-way round in its wyes. If the vertical wire is still tangent to the line selected it may be considered as collimated. Do the same with the horizontal wire, employing some horizontal line for the test.

To adjust the line of collimation, each cross-wire must be brought half-way back to its respective vertical and horizontal line on which the sight was taken. To do this, slightly loosen one of the capstan-headed screws controlling the reticule and tighten the opposite screw, thus moving the cross-wire, in the case of an erecting telescope in the direction of the observed error, and with an inverting telescope, in the direction as if to diminish the error. To test the correctness of the adjustment, set the intersection of the cross-wires on a distant point by means of the leveling and tangent-screws, and carefully return the telescope to its original position. If the intersection of the cross-wires still cuts the point the telescope is collimated.

(*b*) By the first adjustment the intersection of the cross-wires has been placed in the optical axis of the telescope. The object of the second adjustment is to make the axis of the bubble-tube parallel to the optical axis, in order that the line of collimation may be truly horizontal when the bubble is brought to the centre of the tube.

There is more than one method of making this adjustment, but the 'peg method' has the advantage of extreme accuracy, and is therefore recommended. Place the instrument mid-way between, and in line with, two stakes set approximately 270 ft. apart on nearly level ground. After carefully leveling the instrument, particularly over one set of leveling-screws placed in line with the stakes, sight on the rod held in turn on each of the two stakes *A* and *B* (Fig. 1), and record the readings to 1000ths, in the form of notes here shown. Since the instrument is equidistant from the two stakes, all errors due to maladjustment of the instrument and the effect of curvature and refraction are eliminated, and the difference in the reading is the true difference in elevation of the stakes.

Move the instrument beyond one of the stakes a distance equal to one-tenth the interval between the stakes, which in this case would be 27 ft. Level the instrument carefully and read the rod held on *B*.

If the effect of curvature and refraction could be disregarded, the true difference in elevation between *A* and *B*, added to the rod-reading on *B*, if *B* is higher than *A*, and substracted if *B* is lower than *A*, would give the target-setting for a level sight to *A*, provided the instrument were in perfect adjustment. The combined effect of curvature and refraction for 200 ft. sight, however, is 0.001 ft. and varies as the square of the distance. For the distance chosen, namely, 300 ft., the correction is 0.002 ft. This is always a positive correction and must be added to the algebraic sum of the reading on *B* and the true difference in elevation between *A* and *B* to obtain the rod-reading of a level sight to *A*.

Take a rod-reading on *A*. The difference between this and the calculated reading is the error due to maladjustment of the instrument for the distance *BA*. As the correction must be made for the distance *DA*, which is 11/10 *BA*, the error is multiplied by this factor. By noting whether the reading on *A* is higher or lower than the calculated reading, the correction may be properly applied. Set the target at this point on the rod. With the rod held on *A*, bring the horizontal cross-wires to cut the centre line of the target. Turn the telescope 180° and bring the bubble half-way back to the centre by means of the capstan-headed screws, and correct the remainder with the leveling-screws.

To test the adjustment, take a new rod-reading on *B*, add the correction for curvature, and subtract the sum from the calculated target-setting for the level sight on *A*. The difference between this result and the true difference in elevation between *A* and *B* is the amount of error in adjustment still remaining, which can be reduced to 0.001, and should never exceed 0.003 feet.

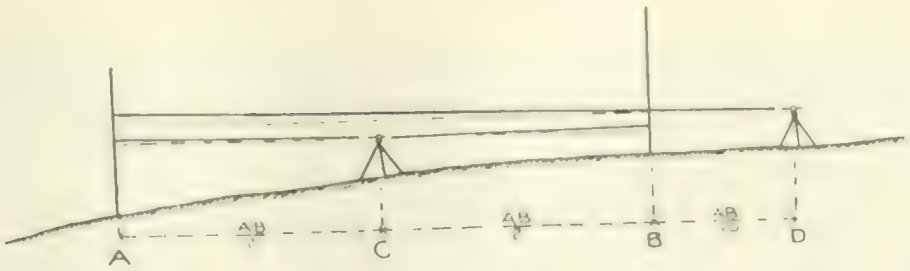
Tapes. The 100-ft. steel tape attached to a reel is indispensable. A 500-ft. tape on a reel is likewise of great use, especially about a mine, where accurate vertical and slope measurements of more than 100 ft. are frequently required. A 6 or 8-ft. pocket-tape is a convenience in measuring the offsets in underground surveying, the width of the vein, and various other short measurements for which a longer tape is cumbersome.

A tape-mending outfit consisting of a combined cutter and riveter and a package of copper eyelets should be included.

Drawing Instruments. The number and assortment of drawing instruments is much a matter of individual taste. A few good instruments, however, will give better service than a larger assortment of an inferior make. The list here given is for a well-equipped drafting-room.

Compass with two steel points, pen, pencil, needle-point, and lengthening-bar.

Beam compass for railroad curves and large circles.



Instrument at C		Instrument at D		
Rod on A	6.025	Rod on B		5.858
Rod on B	3629	Correction for Curvature D - 300'		+0002
True difference	2396	True difference		2.396
		Sum		8.256
		Rod reading on A		8.268
		Difference	0012	
		Difference × 11/10		0.013
		Target setting		8.255
		New reading on B	5.858	
		Correction for curvature	+0002	5.860
		Difference		2.395
		True difference		2.396
		Error in adjustment.		0.001

FIG. 1

Drop-spring bow-pen; spring-blade for very small circles.

One or more drawing-pens.

Proportional dividers with rack movement. This instrument will be found useful in map making, as it is often convenient to plat on a larger scale than the finished map.

The draftsman's steel protractor; blade 8½ in. long, graduated on one side to degrees, with vernier reading to 5 minutes; flush on both sides so that it can be used either side up, and on both edges of the blade.

Rolling parallel-ruler of german silver. This is an indispensable aid to rapid work. Its use will be explained in detail hereafter.

A steel straight-edge when used in conjunction with the parallel-ruler and triangle takes the place of the T-square, which is an unsatisfactory tool unless the table is perfectly true, and great care exercised in its use.

The pantograph is useful in reducing maps. While the more precise instruments are costly, an inexpensive pantograph constructed of wood will serve for rough reductions.

Set of 30° and 60° transparent triangles.

French curves, architect's and engineer's scales.

CARE AND USE OF INSTRUMENTS. In order to obtain accurate results and ensure permanency of adjustment the greatest care should be exercised in handling instruments in the field, and preserving them from injury when not in use.

Handle the instrument carefully when lifting it from, or replacing it in, its case; holding it firmly by the base, and not by the standards, telescope, or circles.

The instrument-case is designed by the maker to hold the instrument in a certain position. On receiving an instrument, study the mode of packing, in order that time may be saved in fitting it in position, and danger of improper packing avoided. Before placing the instrument in its case the foot-plate should be made parallel to the instrument proper, and brought to a firm bearing with the leveling-screws.

Hold the instrument firmly when attaching it to the tripod-head. The lower motion should be loose so that the instrument may be screwed on with the left hand without relaxing the hold with the right. By first turning the instrument-base in the direction of unscrewing, the threads may be more easily engaged, after which there is little danger of cross-threading. With instruments that fit in a socket the same care should be observed in seating them securely on the tripod-head. When the instrument is finally seated, tighten firmly that it may not become loosened afterward.

The bolts that secure the legs of the tripod to the head are apt to work loose, and the instrument becomes unsteady some time before it is noticed. They should be tested often. Experience will indicate to what extent the thumb-nuts should be tightened to preserve steadiness in the instrument and still allow free use of the tripod-legs. Never force the screws when leveling the instrument. Should one set bind, loosen the opposite pair. If the instrument has been so set up that it requires nearly the full limit of the threads to bring it to the level position it is better to re-set it, remembering that the instrument will lose its steadiness if the threads become worn. Be sure that the leveling-screws are firmly seated on the plate without being unduly strained.

Always carry the instrument with its main motion slightly clamped. If allowed to swing loose, the centres will become worn; if too tightly clamped, there is danger

of the instrument if the telescope should be accidentally struck against a rock or limb of a tree.

When adjusting the cross-wires always loosen both sets of capstan-headed screws before attempting to move the reticule.

Keep the needle clamped at all times except when the instrument is set up and leveled. Clamp before picking the instrument up to move to a new position.

ADJUSTMENT OF INSTRUMENTS. If the instrument is out of adjustment generally it is best not to attempt the completion of any single adjustment, but to repeat the whole series until the instrument is in nice adjustment.

(*c*) The object of the Y adjustment is to make the axis of the bubble-tube perpendicular to the vertical axis of the instrument. When this is accomplished the telescope will remain level when turned in any position about the vertical axis.

Bring the telescope in line with one set of leveling-screws and carefully level the instrument in both directions. Turn the instrument about the vertical axis 180°. If the bubble still remains in the centre of the tube, the instrument is in adjustment. If not, correct one-half the deviation with the leveling-screws and the remainder with the capstan-headed nuts at the end of the level-bar. Turn the nuts equally; starting that nut first which is on the side toward which the level-bar must be moved.

Next comes the adjustment of the dumpy level.

(*a*) Bubble-tube adjustment. Level the instrument carefully, particularly over one set of leveling-screws. Turn the telescope 180° about the vertical axis and note whether the bubble still remains in the centre of the tube. If there is any change in its position, bring it half-way back by means of the leveling-screws, and correct the remainder with the capstan-headed screws that raise or lower the bubble-tube.

(*b*) Collimation adjustment. This is accomplished by the 'peg method' already described under the bubble adjustment of the Wye level. Since the level-bar is rigidly attached to the telescope in this instrument, the procedure is the reverse of that employed in the engineer's level. The bubble-tube is first made perpendicular to the vertical axis, and, afterward in the second adjustment, the line of collimation made parallel to the axis of the bubble-tube.

When the correct target-setting is determined, as in the adjustment of the engineer's level, the bubble is brought to the centre of the tube and the horizontal wire raised or lowered until it covers the centre line of the target; care being taken that the bubble is still in the centre of the tube after the adjustment is made.

Now the engineer's transit is to be adjusted.

(*a*) Plate-bubble adjustment. With the bubble-tubes parallel to the two sets of leveling-screws, level the instrument carefully and revolve the alidade 180°. If the bubbles are still in the centre of their respective tubes the alidade will revolve in a horizontal plane when the instrument is revolved about its vertical axis. If the bubbles no longer remain in this position, bring them half-way back to the centre by means of the capstan-headed screws, and correct the remainder with the leveling-screws. It will probably be necessary to repeat this adjustment several times before it is perfect.

(*b*) To make the vertical wire vertical. Sight on a suspended plumb-line or the edge of a building. Carefully loosen the capstan-headed screws and turn the ring holding the cross-wires until the wire is vertical.

(*c*) Collimation adjustment. Set up the instrument in a stretch of open and fairly level ground and sight on a nail driven in a stake at a distance of 200 or 300 ft. from the instrument. Place a smooth object, such as a block of wood or a short board, at an equal distance in the opposite direction. Transit the telescope and direct the assistant in making a pencil-mark on the board exactly in the line of sight. Unclamp the main motion of the instrument and sight on the nail. Again transit the telescope and establish a second point on the board. If the adjustment is perfect, these two points will coincide; if it is not, move the vertical wire by loosening one screw and tightening the other until the line of sight cuts the point one-fourth the distance between the two pencil-marks. Repeat the operation until two pencil-marks successively established coincide.

(*d*) To make the horizontal axis perpendicular to the axis of the instrument. Set the instrument near some high point, such as a flag-pole, tall building, or high bluff. With the telescope direct sight on a fixed point at a high angle and clamp the horizontal motion. Turn the telescope down and set a point on a level with the instrument. Transit the telescope and again sight on the high point. Turn the telescope down and set a second point by the side of the first, and bring the line of sight to cut a point half-way between them. Raise the telescope until the high point appears on one side of the vertical wire. Raise or lower the adjustment end of the horizontal axis until the horizontal wire cuts the point.

(*e*) The telescope bubble adjustment by the 'peg method'. This is carried out in precisely the same manner as already described under bubble adjustment of the engineer's level.

If an engineer's level is handy, a rapid adjustment of the transit-level may be made by placing the two instruments side by side and as nearly as possible at the same height. By sighting through the former instrument a distant object may be chosen on the same level with it, to which the cross-wires of the transit-level are adjusted.

(*f*) Vertical-circle vernier. The vertical circle should read zero when the bubble under the telescope is in the centre of the tube. If the zeros of the vernier and the scale do not coincide, loosen the screws that fix the vernier to the standards and shift it to the proper position. Tighten the screws, being careful that the edges of the vertical circle and the vernier are flush.

(To be Continued)

STREAM TIN, a form of cassiterite, the most valuable ore of tin, has been found in many streams in Alaska, and lodes of cassiterite have been prospected and mined at several places in the Territory.

REVIEW OF MINING

FROM OUR OWN CORRESPONDENTS IN THE FIELD

ARIZONA

CONDITIONS AT MIAMI.—I. V. X. HAS PURCHASED CLAIMS.

MIAMI.—The Inspiration concentrator is operating 14 out of its 20 sections at present, there being no change in production. The International smelter is operating two reverberatory furnaces; the third is down for repair but is expected to be in operation again within a few days. Production from each furnace is about 100 tons per day. Last month's production was 13,352,000 lb. of copper. Operations at the Miami Copper Co.'s property continue the same as for the past several weeks, the concentrator operating four of its six sections. Last month's production was approximately 4,900,000 lb. of copper. The erection of the new hoist-house at No. 5 shaft is nearing completion, and the erection of the steel head-frame will be started soon. Van Dyke Copper has resumed sinking its No. 1 shaft after installing a large steam-hoist. The shaft now is 480 ft. deep. Sinking has been greatly facilitated by the new hoist. Bailing is the only method for removing the water found necessary up to the present time, as the shaft is not making water in sufficient quantities to make pumping equipment necessary. If more water is encountered before reaching the orebody, the present steam equipment will be of sufficient size to operate the necessary sinking-pumps. Until the shaft has reached and passed through the orebody, it is the intention of the management to confine its efforts solely to sinking. Lateral development will start after passing through the ore discovered by diamond-drilling at 1170 feet.

More development work has been done in the last month by the Superior and Boston than in any month during the last two and a half years. An important ore discovery was made on the fourth level, where the footwall vein has been intersected by a cross-cut. Eight feet of ore averaging 8% copper was found, with the face of the drift still in ore. The extent of the shoot is unknown at present; it will be necessary to drive in both directions along the vein to determine its limits. The importance of the discovery lies in ascertaining that ore exists in this vein, and in demonstrating the correctness of the development program of the property. A cross-cut is being driven on the 800-ft. level to pick up the limestone and black oxide veins as well as to explore hitherto unknown territory. On the 10th level the eastern end of the mine is being opened up 500 ft. east of all previous workings and a cross-cut is being driven to intersect the Old Dominion and Great Eastern veins. On the 1200-ft. level a cross-cut is being driven north and south for the same purpose. One of the most important pieces of work being done is diamond-drilling from the 1200-ft. level to cut the Old Dominion vein in the Pinal schist below the lower diabase sill.

JEROME.—The United Verde Extension Copper Co. has purchased the eight patented claims of the West United Verde Copper Co. for a quarter of a million dollars. According to a statement made by George Kingdon, general manager of the United Verde Extension, development of these claims will not be carried out till a more favorable time. Negotiations for the purchase of these claims has been under way for some time. The property in question was located 15 or 20 years ago by Chris Harryhausen, long a foreman at the United Verde mine; eight of the claims were taken over from him by the Jerome Development Co. Exploration was carried on by this company but without success. After a long period of inactivity the Haynes Copper Co. acquired control and spent a considerable sum developing. Soon after the United Verde Extension's discovery, Michigan people took over the claims and organized the Jerome Verde Extension Copper Co. This company spent a quarter of a million dollars in development, and then interested some New York capital and reorganized as the West United Verde Copper Co. It is also announced that the United Verde Extension main haulage tunnel will be ready for operation on November 15. For the present there is to be no change in the tonnage and grade of ore shipped to the smelter in spite of the increased facilities afforded by the tunnel's completion.

According to the engineer's report just issued, the production of the Jerome Verde Copper Co. for the year aggregates 4709 tons with an average content of 9.6% copper. The total cash income was $108,359. During the past year 2282 ft. of driving and raising and 3106 ft. of diamond-drilling were done. Most of the development has been carried on in the Maintop shear-zone. The future of the company, according to the engineer, will depend on the discovery of new orebodies, there being practically no ore-reserve at present.

PRESCOTT.—It is reported that the Bullard mine has been sold for $750,000, there being a large cash consideration. Preliminary work on a large scale is being carried on. The White Star group of silver mines at Turkey Creek has been sold. Since last May the owners have carried on extensive sinking and driving which has opened high-grade silver-copper ore. The Blue Jacket

Mining Co., newly organized, has purchased the Blue Jacket claim situated at Crown King for $50,000. This claim is contiguous to the Silver Crown mine in which there was recently made a discovery of considerable importance. A discovery of rich silver ore has been made at the Silver Crown Mining Co.'s mine. The tunnel that was being driven penetrated a zone which showed 2 ft. of 110-oz. silver ore and 4 ft. of milling ore. The Postmaster and Money Metals groups of claims in the Big Bug district near Poland are being revived by W. J. Torback. New machinery has been ordered for development and is being freighted in. The company proposes driving a tunnel which will cut the vein at a depth of 500 ft. from the surface.

COLORADO

CRIPPLE CREEK AND LEADVILLE NEWS.—OLD PANDORA MILL BURNED DOWN.

CRIPPLE CREEK.—A leasing company similar to the Isabella Leasing company, which was recently incorporated, is being contemplated by stockholders of the Elkton Consolidated Mining & Milling Co. It is understood that the board of directors has been sounded as to the possibility of securing a lease that will ensure development of the Raven Hill estate at depth. Connection will shortly be completed by cross-cut between the Moffat tunnel and the Blue Flag workings. On account of the Blue Flag adjoining the Ida May group of the Elkton company on the north, its development from that direction is impossible. The movement is reported to meet with the approval of many of the stockholders and a special meeting may be called to arrange for the organization of a leasing company. No work is now being done on the estate, except by lessees who are making fair production from the leased territory south of the shaft.

The Isabella Leasing company has the 15th level of the Lee or main shaft of the Isabella Mines company unwatered, and cross-cutting has started for the Buena Vista, Emma, Maloney, Orphan Belle, and other veins that have been ore producers in the past.

LEADVILLE.—With approximately 90% of the present work in the Leadville district already carried on by lessees, a movement is on foot to secure favorable terms in order to bring about the development of properties which have been idle for long. Many of these are known to contain large bodies of silver-bearing ore, although several of the owners are satisfied to await a more favorable time, leaving their ground idle and paying but a light tax on undeveloped property.

A syndicate of local operators headed by John Cortellini, the Joyce brothers, Theo. Zadra, D. Canfield, and others are actively developing the Adelaide Park properties, the Dolomite, General Grant, Laurel, and Echo through the Dolomite shaft. A drift is being driven now to locate the orebody in the first contact, and the syndicate is already planning to sink deeper and also to work through the shaft on the General Grant. A contract for 100 ft. of sinking has also been let by Frank G. Peck, president of the Portland company of Cripple Creek, on the Clear Grit, in Iowa gulch. Prospecting will be started in this shaft when the station is cut at the 500-ft. level.

Leases have been granted for blocks which are traversed by the Yak tunnel and the monthly output, made by lessees, now closely approximates 10,000 tons. Articles of incorporation have been filed with the Secretary of State in Denver for the Leadville Development Co., composed of local men. The company, which is capitalized for $100,000, will operate both lode and placer mines in Lake county, Colorado.

TELLURIDE.—The Smuggler Union Mining Co. sustained a heavy loss by fire when the old Pandora mill was burned on October 30. The entire structure was a total loss, together with a large amount of machinery that had not yet been transferred to the new mill. The fire was caused by a defective flue in the assay-office. The mill was a frame structure, covered with corrugated iron, 100 by 150 ft., the assay-office occupying an extension 50 by 75 ft. There were four decks, equipped with 85 stamps, vanner, Wilfley tables, and other milling machinery, much of which was still on the floors, although some had been transferred to other buildings and the new mill. The assay-office was the only portion of the building in use, although at various times separate units of the mill have been run temporarily.

The fire was observed at 8:45 a.m., and a large force of men rushed to the scene, but the water system was frozen, and the delay permitted the flames to obtain headway. Pyrene extinguishers were used but the fire was too far advanced to be overcome by these. The Telluride fire department co-operated with the local men, so that there was a total force of 100 men trying to save the old mill. When the fire got beyond control, all effort was concentrated on saving the nearby buildings, and salvaging a quantity of chemicals and movable equipment stored in the mill. Fortunately the wind direction was favorable, and the flames were swept away from the new mill and other buildings; had the wind veered, no doubt the entire town of Pandora would have been burned out. Interesting incidents in connection with the fire are the facts that although the Tomboy tramway passes directly over the burned mill it was not stopped by the flames, suffering no appreciable damage, and the water plant of the mill remained intact. The loss is estimated to be $65,000 of which $50,000 is covered by insurance.

The mill was an interesting structure from a historical viewpoint, as it occupies the site of and is a successor to the first mill built in this district. The Pandora and Oriental mill was built in 1883, running 10 stamps. A few years after its construction it was carried out by a snow-slide. A 20-stamp mill was built to replace it, and in 1887, the New Pandora & Oriental Co. took over the property, transferring it the following year to the Sheridan and Mendota Mining companies. Upon the formation of the Smuggler Union Mining Co. in 1891, the mill was among the properties consolidated, and was remodeled by this company to handle heavy tonnages of ore,

but abandoned a few years later when the new mill was completed.

The three companions of the murdered miners in the Montana tunnel mystery have been indicted for the crime, and are awaiting the next session of the district court.

MICHIGAN

NO INCREASE IN PRODUCTION.—WOLVERINE MINING IN THE FOOT-WALL.

Production figures for the month of October have not yet been compiled, but preliminary estimates indicate there will be no increase over the September showing. The Calumet & Hecla group of mines may show a small

THE SMUGGLER UNION MILL AT PANDORA

increase, but the Copper Range mines and the Mohawk-Wolverine properties will show a slight falling off.

Stocks of copper on hand at the local smelters will be out of the way by the time navigation closes. This is rather unexpected owing to the fact that the accumulated supplies had hitherto been taken to indicate the impossibility of marketing the copper. The probabilities are that the copper has not now been sold, but has gone to Buffalo or New York for storage.

There is an apparently authentic report of the sale of 20,000,000 lb. of Michigan copper to German interests, although details are lacking. Before the War Germany was a heavy buyer of Lake metal, Hamburg taking almost as much Michigan copper as Liverpool, but since the armistice the foreign demand has not returned to anywhere near normal. This 20,000,000 lb. demand from German interests is the first large sale to Germany in many years. It is reported that this was financed by New York banking houses who are not giving any publicity to their plans.

All mechanical operations at the Victoria mine are performed by compressed air, which is compressed in an underground chamber by the fall of the Ontonagon river. This little mine produced in October 110,160 lb. of ingot copper, an average of 14.4 lb. per ton, which is better than it has averaged for a long time. The Victoria continues to operate at a small profit simply because of its natural advantage in the way of power. The company has developed a social service program so that it rarely loses a workingman. For years this service in a little mining location, away from any sizable town, was looked upon as a fad. Today many of the larger corporations gladly are copying it. It is a recognizable industrial asset at the present time.

The Wolverine mine, near Calumet, for many years recognized as the 'richest little copper mine' in the world, is now getting to a point in its career when plans for removing the pillars are being made. Driving back of the foot-wall found a lot of copper in a Kearsarge lode vein-width of 25 ft. that permitted mining at a profit. The ore once contained 40 lb. of copper per ton. Now it is an exceptional month when the average is 20 lb., and a profit is made on 15 lb. The management had to determine whether to shut-down, after removing the pillars, or to go back through the mine and explore the territory back of the foot-wall. For years the old miners here contended that there could be no ore back of the foot-wall. They said this so often that everybody believed it. But in the end the company decided to explore behind the foot-wall, which resulted in much workable ground on many levels. A lot of supposedly worked-out levels in the Wolverine are today furnishing the bulk of the ore which this property sends to the mills. From the standpoint of the shareholders of the company it is worth getting out. Incidentally the Wolverine-Mohawk tunnel at the stamp-mill at Gay ought to be completed by February 1. The 1250-kw. turbine for the pumps is on the ground and is being set up to be in readiness for operations when the tunnel is completed.

NEVADA

TONOPAH DIVIDE TO RESUME SHAFT-SINKING.—POSSIBILITY OF A STRIKE AT GOLDFIELD.

DIVIDE.—Sinking the shaft of the Tonopah Divide from the 585-ft. level is to be resumed within a short time and will be continued until the sulphide zone is reached, which, according to early estimates, should be at from 700 to 800 ft. The new shaft of the Divide Extension is 200 ft. deep and a cross-cut is being driven east to cut the extension of the rich ore found on the upper levels. The Victory, Belcher, and Belcher Extension, lying along the strike of the main vein of the district where it turns north-west around Gold mountain, are again working on a good scale. As a result of surface exploration during the labor trouble the course of the vein has been definitely determined, and the Belcher, at 200 ft., the Belcher Ex. at 300 ft., and the Victory at 230 ft. are driving toward important objectives. Good widths of mill-ore, with seams of higher grade, have been found on the surface of the claims of the three companies. The Butte, south of and adjoining the Belcher and Victory, is planning to

sunk another 50 ft. to a depth of 200 ft. and explore the vein, striking south-west from the Victory, believed to be a spur from the main ore-channel. The south-west vein strikes toward Revert, Silver King, and Mecca.

EUREKA.—The main winze from the 400-ft. level of the Eureka-Croesus has reached the sulphide zone at 300 ft. and at this depth the ore is being broken over a width of 15 ft. The copper content is increasing, with the value the same as the average above the water-level.

MINA.—What is said to have been a record shipment of quicksilver from Nevada was made recently from the Pilot Mountain district, 12 miles east of Mina. The shipment consisted of 99 flasks, valued at $7400. The principal producers are the Mina Quicksilver Co. and the Mina Mercury Co., the claims of the latter being operated under lease. The ore occurs in irregular deposits and, with the quicksilver, contains lead, silver, gold, zinc, and antimony. It is high-grade, assaying from $500 to $1000 per ton over 4 to 6-ft. widths in places. Only the quicksilver is extracted.

GOLDFIELD.—A strike again threatens in Goldfield, started, according to reports, by the man who led the Tonopah-Divide walk-out. Little if any trouble is anticipated. A committee representing a minority of the miners has published a statement in which the Tonopah wage scale, based on $6 for miners, is asked, but no formal demand has been made on the operators. The wages in Goldfield vary, most of the companies using a bonus system that makes a wage of from $5 to $5.50. The workers in their statement claim that living costs are higher than in Tonopah. The General Washington, owning a claim and a fraction south-east of and adjoining the Cracker Jack and on the strike of the vein being developed by that company, is being re-financed for work through the 320-ft. level of the Cracker Jack. One hundred feet of driving will be necessary to reach the General Washington boundary line. The ore-shoot opened recently in the Red Hill south of the Florence fault has proved unimportant. Low assays are now being obtained in a second shoot. Men interested in the Goldfield Development Co. are reported to be negotiating to take over the Yellow Tiger, far south-east of the Florence. Considerable development work with fair results was done in the Yellow Tiger up to 10 years ago. The west cross-cut on the seventh level of the Florence is 373 ft. long and the south-east cross-cut on the same level, at 236 ft. from the south drift, is in the main Florence fault. The average value of the last 7 carload shipments from the Florence Divide lease was $88 per ton. The 7 cars contained a total of 320 tons of ore. The Adamson, Traynor & McCall lease has made a carload shipment estimated to be worth $26 per ton and the Dunn lease in the old Engineers' block is preparing a shipment from a seam 18 to 20 in. wide and assaying $130. In a telegram from New York, A. H. Merrill, president of the Merrill Silver-Lead Co., states that he has been successful in raising $50,000 for the treasury of the company. The Merrill Silver-Lead, promoted by Goldfield mining engineers, owns claims 10 miles south of here. A. I. D'Arcy, general manager for the Goldfield Development Co., states that no attempt will be made to operate the mill of the company until spring and that the winter will be devoted to enlarging the plant to 2000 tons daily capacity.

UTAH

OPERATIONS AT THE UTAH APEX. CAR SITUATION AND SHIPMENTS FROM EUREKA.

SALT LAKE CITY.—The close of the first week of the coal miners' strike finds Utah in the best condition of any coal-producing State in the Union. On November 2 orders were received from the Regional Director of Railroads to hold all cars at convenient points. This resulted in about 45,000 tons of coal being held on the Denver & Rio Grande railroad between the coal mines and Salt Lake City, and, as a result of this order, the coal mines were short of empties for loading. Civic organizations in Salt Lake City sent vigorous protests to Washington, with the result that on November 6 orders were received by the local railroads to release all cars of coal, irrespective of destination or consignee. The Union Pacific Railway is drawing heavily on the Utah mines at present, fully 60% of all run-of-mine coal going to that company. As a general rule, the coal mines have a plentiful supply of labor; only a small percentage of union miners quit work on November 1 and left for other districts. As yet, there have been no reports of coal shortage in any of the metal mining camps of the State.

BINGHAM.—It is announced that the annual report of the Utah Apex company, covering the fiscal year ending August 31, 1919, will not be issued until December, owing to pressure on officials of the company in preparing for apex suits. Important bodies of milling ore have been encountered during the past year on the 100-ft. level and in a winze below that point. Reserves of this class of ore amount to 50,000 tons, averaging 8% lead and 2 oz. of silver per ton. New bodies of shipping-ore were encountered on the 1150, 1225, and 1300-ft. levels, and reserves of this type of ore are estimated at 160,000 tons, averaging 12.5% lead and 4 oz. of silver per ton. The company is devoting considerable time and attention to flotation. Both the local and Eastern executives are of the opinion that excellent results can be obtained from the use of the Minerals Separation process, particularly in the recovery of zinc, which heretofore has been figured as a worthless metal in the smelting of the lead ores. If tests now under way by the Minerals Separation Co. are successful, the process can undoubtedly be adapted to the present mill with a small amount of alteration and additional flotation machinery.

EUREKA.—The railroad car situation, so far as this district is concerned, shows a decided improvement since November 1, the railroads being able to supply all the cars needed. Shipments of ore for the week ending November 7 totaled 118 cars, as compared with 102 cars for the previous week. Of the above total, Chief Consolidated shipped 26 cars; Dragon, 24 cars; Iron Blossom, 13 cars; Colorado, 9 cars; Tintic Standard, 9 cars; Swansea, 7 cars; Eagle & Blue Bell, 7 cars; Centennial-Eureka, 5

cars; Grand Central, 4 cars; Ridge and Valley, 4 cars; Gemini, 3 cars; Victoria, 2 cars; Sunbeam, 2 cars; Mammoth, 2 cars; Primrose, 1 car; Eureka Hill, 1 car. Output from the Tintic Standard shows a decrease, but this was due to change in the manner of loading ore, the loading-station on the slope above Elberta having been torn down and re-erected at a point on the new East Tintic railroad, which is much nearer the mine.

PARK CITY.—Shipments from this district for the week ending November 7 show an increase over the previous week. A total of 1574 tons was shipped, of which the Ontario Silver produced 421 tons; Silver King Coalition, 418 tons; Daly West, 320 tons; Judge M. & S. Co., 301 tons; Daly Mining, 108 tons; and Silver King Consolidated, 55 tons.

Recent developments in the Naildriver mine have been

PORTAL OF THE SUTRO TUNNEL, COMSTOCK LODE, NEVADA

encouraging, and shipments during the present month will be the heaviest of the year. Development work is progressing satisfactorily in the Park-Utah mine, with good prospects for interesting developments at any time. The face of the south drift is in mineralized matter, with layers of low-grade ore two to four inches wide, with an occasional streak of high-grade galena. Recently a discovery of about 14 inches of high-grade silver chlorides was made in the Three Kings Consolidated mine. This was made in fissure No. 4 while excavating work was being done for the purpose of putting in a higher headframe. Within a short time several tons was taken out.

ALTA.—Development work in the Emma mine, which was started early in November, following the unwatering of the main shaft, has revealed a streak of high-grade ore, which assays 182 oz. of silver and 42.3% lead per ton, according to G. H. Dern, general manager for the Emma Silver Mines Co. The mine is looking very good at present, according to Mr. Dern. It is operating three shifts, but shipments of ore have been retarded lately, owing to discontinuance of operations on the Salt Lake & Alta railway in Big Cottonwood canyon. Contract has been let for the hauling of ore by team, and the first loads were hauled down to valley smelters on November 11. The company is also working on a new vein farther up in the stope, which assays 135.6 oz. silver and 7.1% lead per ton.

BRITISH COLUMBIA

DISTRICT AROUND STEWART IS READY FOR THE WINTER—BONANZA MINE UNWATERED

STEWART.—This mining centre may be said to be 'all set' for the winter. Although many of its inhabitants have come south to spend the more severe months of the season, there will be some 150 people remaining in the town until spring. A school has been opened and a good class of children has been mustered. In short Stewart, not much more than a year ago deserted and without prospect of rehabilitation, is assuming the aspects of a permanent community and its residents have the utmost faith in its future. Chief among the causes of this sudden development is the discovery of the Premier mine, on which work is to be continued during the winter and from which several shipments of bonanza ore are expected before the spring. The Big Missouri, Joker, Forty-Nine, and Bush also are promising groups of mineral claims, which are confidently expected to prove the mineral worth of the district of which Stewart is the Canadian outlet. While they are not yet proved mines, development in some instances is well advanced, and trial shipments probably will be sent to the smelters this winter. In addition there are many prospects, the surface showings of which are most encouraging, the result being that prospectors and operators predict that Stewart is to be a mining town of first importance in the Canadian North-West, and that this will become more generally recognized during 1920.

On the Big Missouri the drilling has ceased for the

winter, and will be resumed on the return of better weather conditions. Work is to proceed without interruption in the driving of a cross tunnel on the E. Pluribus claim, on which a high-grade body of ore is being developed. The Province group, it is expected, will be developed by diamond-drill next season. Drilling on the Forty-Nine also is finished for the year but a considerable force of men will be maintained during the winter months. The Bush mines, north of the Premier, are being extensively developed with encouraging results, ore of the first grade having been struck. On the New Alaska a tunnel is being driven to open up the orebody. The Nabob group, on Glacier creek, has been bonded by C. G. Skoning and associates of Leadpoint, Washington. An assay of samples from this property secured by Mr. Skoning before the closing of the deal is said to have given returns of $189 in silver per ton at current prices. Mr. Skoning, who has come south, proposes returning in the spring with the machinery necessary to open up this group.

YALE.—The Joshua shaft at the Donohue mine has been unwatered for the first time since the English company ceased operations, 30 years ago. The workings were found to be in excellent condition and the vein stronger and better mineralized than in any other part of the mine. A new bunk-house has been erected, and accommodation made for a large force of men. New air-compressors have been ordered. Arrangement has been made to drive a tunnel from the lake shore to cut the Joshua, King William, and Tubal Cain veins at the 300-ft. level. Joseph Errington, consulting engineer to the company, has been making a thorough examination of the Aspen Grove mines. As a result a considerable amount of diamond-drilling is to be done to see if the veins persist in size and richness. A number of adjoining claims have been added to the company's property, making a consolidation of 75 mineral claims.

ASHCROFT.—Arrangements are said to have been completed between the Highland Valley Mining & Development Co. and its creditors, and operations at the mine are to be re-started. The creditors are to receive one-tenth in cash and one-tenth at one, two, three, and four months, and the balance in 7% preferred shares.

FORT STEELE.—G. Grundy, who has a lease of the Victor mine at Mouse creek, has started to erect a 50-ton concentrator.

CARIBOO.—On account of the early severe cold weather, dredging operations at Wild Horse creek have been suspended earlier than usual. Development at the Wigwam mine by the Lightning Creek Gold Gravel & Drainage Co. will be carried on under the supervision of John S. Hogan, president and managing director for the company. A shaft will be sunk to bedrock in the old channel in the centre of the company's property.

NELSON.—S. A. Sorenson, C. H. Holme, and P. H. Peterson have discovered silver ore on Vernon mountain and have staked three claims. The vein has been traced for 600 ft. and is one to three feet wide. Assays run from 123 to 167 oz. in silver per ton. It is a 'dry' ore, containing only traces of lead and zinc. A compressor is to be added to the equipment at the Ore Hill group, and a tunnel will be driven to cut the veins at 500 feet.

ONTARIO

LIGHT RAILWAYS TO SERVE OUTLYING MINING DISTRICTS.—PORCUPINE MINES INCREASING PRODUCTION.

COBALT.—Metal authorities of Canada have taken careful note of the recent legislation in Great Britain, which makes it a criminal offense to melt down silver coins, and places an embargo on silver exports. In Canada the rate of exchange with the United States, although not altogether alarming, and not yet sufficient to place the value of the silver in each coin on a parity with the value of the coin itself, is, nevertheless, quite threatening. Further advance in quotations for silver, and increased rates of exchange might compel Canada to adopt similar legislation as that enacted in England, according to the opinion of mine operators.

Official advice from the Department of Mines to the correspondent of the 'Mining and Scientific Press' conveys the information that the Provincial government has "entered into a temporary arrangement with Mr. Solloway, who desires to construct light railways along the lines of those used in France for transportation of munitions", these lines to be constructed for the benefit of the outlying mining districts of Northern Ontario, such as Gowganda, Fort Matachewan, Larder Lake, and Boston Creek. The announcement has aroused keen interest in the districts affected. The granting of a charter is said to be under consideration.

According to advance official information, the annual report soon to be issued by A. A. Cole, mining engineer for the T. & N. O. Ry., shows that during 1918 some 212 mines shipped silver ore from Cobalt amounting to 17,911 tons; this is in addition to the usual large amount treated in local reduction plants. The report shows that 17 gold mines in the district of Temiskaming are equipped with facilities for treating 6660 tons of ore daily.

The president of the McIntyre-Porcupine Gold Mines states officially that the mine is expected to yield upward of $1,000,000 net profit this year. The general manager declares mill-heads will probably average about $11 per ton, and costs may amount to about $5 per ton.

The Canadian Victory Loan for 1919, with an objective of $300,000,000, is a success. At the time of writing, the objective has been reached; and, with another week to go the total promises to reach at least $500,000,000.

At a meeting held in Toronto on November 7, the shareholders of the Trethewey-Cobalt Co. ratified a by-law authorizing the company to purchase additional shares in the Castle company on a basis of one share of Trethewey for two shares of Castle stock. The motion in the litigation concerning the Bailey-Cobalt mine, which was to have been heard in Toronto on November 5, has been enlarged till November 19. The shareholders of the Gold Reef Mining Co. on November 7 ratified a by-law which authorizes the company to increase its

capital from $1,000,000 to $3,000,000. The Beaver Consolidated continues to encounter high-grade ore in the two veins recently opened up.

PORCUPINE.—All the leading mines of this district are increasing production and aiming to take advantage of more favorable economic conditions than have prevailed for some years. The aggregate capacity of the plants already installed in the district is estimated at approximately 6700 tons daily, of which less than half are in operation, treating about 2500 tons per day. It is claimed that the Dome Mines is now producing gold at a lower cost than any other mine in Canada owing to improved facilities for ore-handling. With mill heads averaging about $8 per ton it is anticipated that the profits will be ample to provide for a 20% dividend rate next year. Preparations are being made to draw ore from stopes opened up on the Dome Extension, foreshadowing the exercise of the option held on that property. W. H. Pritchard, an experienced mining contractor, has been engaged to resume operations on the Big Dyke, the shaft on which is to be put down to the 300-ft. level. At the Clifton-Porcupine three veins are being developed on the first level, which show a good grade of ore. Diamond-drilling on the Gold Reef has shown encouraging results, several veins stated to carry high gold content having been cut at a depth of 70 ft. A discovery of rich ore on the 600-ft. level of the Davidson is reported. Charles A. Randall, formerly manager of the Dome Lake, has been placed in charge of the North Davidson. Satisfactory arrangements for financing the development of the property have been effected.

GOWGANDA.—The Tretheewey has been developing the Castle under option for some time. A rich vein 4 in. wide has been encountered on the property. The Tretheway has also taken a long-term option on the Major, including 112 acres underlying Miller lake.

MANITOBA

RICE LAKE.—A transaction which is likely to have an important bearing on the Rice Lake gold district of Manitoba is the purchase by Gordon C. McTavish of the holdings of the estate of the late Angus McDonald, comprising about 80 claims. Mr. McTavish has strong financial backing and exploratory work will be undertaken on a large scale and the value of the district thoroughly tested. The Gold Pan, of which Mr. McTavish is secretary-treasurer, recently engaged J. B. Tyrrell, mining engineer of Toronto, to make a thorough examination of the property. While unable to make a complete investigation owing to water in the shafts he reported that the company was fully warranted in going ahead with development.

SONORA

ORE AT NACOZARI CON. IMPROVING.—NORTH TIGRE HAS COMPLETED NEW MILL.

NACOZARI CONSOLIDATED.—The annual meeting of the Nacozari Consolidated Copper Co. was held in Douglas on November 10. The annual report, which included encouraging news regarding the recent discovery of copper-bearing material in the brecciated zone, about 4000 ft. from the portal of the main working tunnel of the property near Pilares, was read. The grade of the ore in the tunnel is increasing constantly, it was stated. The old officers and directors were re-elected. They were John G. Alexander of Douglas, president; Thomas D. East of Trinidad, Colorado, vice-president; B. R. Russell of Douglas, secretary; Roy Hiatt of Douglas, treasurer; George Motz of Douglas, superintendent and director; Reginald C. Heath of Boston, Massachusetts, director; L. Melton Williams of University Park, Iowa, director. A brief outline of company plans for the immediate future is understood to have been given at the meeting but was not made public.

LUZ BLANCO.—Manuel Canez and associates have taken over the Luz Blanco in the Roy mining district, between the North Tigre and Cinco de Mayo and are driving a tunnel to reach the main orebody. Considerable silver ore already has been developed. The mill on the Roy mine, closed down for several weeks in order to obtain necessary parts for a broken gasoline engine, has reopened and is turning out concentrate every day for shipment through Douglas to El Paso. This property is operated by Col. B. A. Packard and associates of Douglas.

NORTH TIGRE.—This property, lying to the north of El Tigre, has just completed the erection of a 50-ton mill, using water concentration in connection with flotation, a process evolved after long study of the ore. Underground development offers little of interest except that two weeks ago the fault in No. 8 tunnel was run through and a body of good silver ore discovered on the other side of it. No announcement as to size or grade carried by this body has been made. No. 8 tunnel is the lowest working of the property at the present time and has a vertical depth of approximately 800 ft. The property employs about 30 men and is under the active management of Frank J. Holmes.

DOS CABESAS.—The Dos Cabesas probably is the most easterly property in Sonora working at the present time, being situated on the western slope of the Sierra Madre mountains, close to the boundary between Sonora and Chihuahua. Although it has been operated for several months under a lease by Millard Haymore, of Douglas, and Frank Whalen, it has not been molested by bandits, but numerous rumors of the proximity of Villistas have kept the workers on edge much of the time and made for lost efficiency. The mine has rich bodies of silver ore and is shipping the product that will carry freight and smelting charges, as well as concentrates from a small mill combining water concentration and flotation processes. The first shipment of concentrates received at the border recently showed a high recovery in the mill. Shipping is done by Bacerac to Agua Prieta, pack trains and wagons being employed.

SAN LUIS.—The San Luis property lying near the Cinco de Mayo is being operated under lease by Douglas interests and a small force now is taking out ore for shipment to the El Paso smelter. It is a silver property.

SUSPENSION OF ASSESSMENT WORK

H. J. R. 241, the text of which was given in our last issue, was signed by the President on November 13 and therefore became a law on that date. This Act suspends the requirements for assessment work during 1919 on unpatented claims of every description, lode, placer, or oil, and sets no limit to the number of claims for which exemption may be asked by the owner. This relieves the situation created by the previous Act, which limited the number of claims that could be exempted to five.

Blank notices of desire to hold mining claims under this Act, which must be filled in and filed before December 31, 1919, in the office where the location notice or certificate is recorded, are being distributed free by the California State Mining Bureau from its main office in the Ferry Bdg., San Francisco, and from its branch offices at Redding, Auburn, and 312 Union League Bdg., Los Angeles.

CALIFORNIA

Auburn.—The Placer Chrome Co. is completing a new concentrating mill at the foot of the gravity tramway from the mine. This eliminates hauling ore by motor-trucks. The old plant is running with one shift and several carloads of concentrate have been shipped recently to Eastern buyers. ——Jeffrey & Day have been granted a permit by the California Debris Commission to operate the Lost Cabin hydraulic mine, two miles from Blue Canyon. Equipment has been installed and a test run will be made as soon as sufficient water is available.

Etna Mills.—The Homestake mine, under the ownership of R. S. Taylor and partners, of Yreka, and situated in the Salmon country, has suspended operations for the winter. J. Boyle, Sr., superintendent, and John Allen arrived in Etna Mills today. The snow on Salmon mountain is piling up, the drifts making the roads almost impassable for trucks.

Grass Valley.—The vein of the State Highway mine, south of Grass Valley, was struck in a new place when a shaft was sunk to a depth of only eight or ten feet. A sackful of specimens was taken out, all showing visible gold. The shaft was sunk on the apparent course of the vein at a distance of several hundred feet from the shaft, at a place where there was no outcrop.

Keswick.—The Pittsburg & Mt. Shasta Co. has let contracts for sinking a 500-ft. shaft at the Little Nellie mine. The shaft will be sunk near the end of the 3800-ft. tunnel to develop large bodies of copper ore indicated by diamond-drills. The property adjoins the Mountain Copper holdings and was formerly noted for its gold output.

Meadow Lake.—The shaft of the Excelsior mine is being deepened under the direction of Peter Bokay, who has erected a plant on the property. The Excelsior has not been worked since 1905, at which time some good ore was extracted. It is now planned to work the mine on a large scale.

San Andreas.—New York capitalists, including Senator Gates and Baldwin Bros., have acquired 800 acres of placer ground near Sheep Ranch, including the Rigney, Cuneo, and Seiefert ranches. It is planned to build a reinforced concrete dam to back up the waters of the San Antone, San Domingo, Slate, Calaveritas, and Cherokee creeks, and to operate with water from O'Neil creek and storage reservoirs. It is reported $1,000,000 is to be expended on improvements and equipment.

Soulsbyville.—A 3-ft. shoot of ore assaying around $75 per ton is reported exposed on the 1800-ft. level of the Black Oak mine. The discovery was made in the north end of the property in virgin territory. Specimens are on display in Sonora. Driving has started both ways on the vein, which is reported to be growing larger.

Sutter Creek.—The Central Eureka Co. has officially announced that $50,000 is in the treasury after payment of all bills to November 1, and that the physical condition of the mine is the best in its history for many years. It is rumored here that a dividend is contemplated, but this lacks official confirmation. It is officially stated that splendid ore has been opened in the main workings on the lower levels, and that development of new territory is being vigorously continued. The entire plant is now operating.

Volcano.—Preparations are being made for resumption of work at the Tom and Dick property after ten years of inactivity. San Francisco people have become interested and good ore is being opened.——R. W. Garrity of San Francisco has acquired the Flat Iron property, which has been operated steadily three years.

COLORADO

Cripple Creek.—Mine operators are advised that treatment soon will be resumed at the Colorado Springs mill of the Golden Cycle Mining & Reduction Co., and although there has been little falling off in shipments to date, operators are relieved to hear that settlements will again be prompt. This particularly encourages the small operator, who is dependent upon the returns for his payroll. The November production, however, will necessarily be light, through the temporary closing down of the mill. The Independence mill of the Portland company, treating low-grade mine and dump ores, is electrically operated and the tonnage treated will be normal.

Leadville.—Jesse F. McDonald, superintendent for The Down Town Mines Co., is employing every available miner, exploring undeveloped territory in the search for new orebodies. The work is at present confined to the Down Town basin and the Penrose mine, where ore streaks are being followed and are expected to lead to large orebodies. The Penrose continues shipping, but the production has fallen to about 50% of the output of the corresponding period of 1918. Large bodies of silver, lead, copper, iron, manganese, carbonate of zinc, and a sulphide conglomerate have all been found in large orebodies in the Penrose, and the discovery of new orebodies in this territory would cause little surprise to local operators.

IDAHO

Coeur d'Alene. The Western Union Mining Co., operating in the Evolution mining district, three miles north-west of Wallace, has accumulated another carload of ore which it is expected to ship in a few days. The first carload was shipped a few weeks ago. It was composed of 35 tons of lead-silver ore, for which $2885 net was received. This ore

was removed in the course of development. The body from which it was taken is 8 to 30 in. wide and composed chiefly of clean ore. The quantity of milling ore is small. The shoot has been followed by a drift for 175 ft. at a depth of 1200 ft. The company expects to begin the shipment of ore soon at the rate of two carloads monthly.

A report of the Marsh Mines Consolidated, just issued, tells of the discovery of the Russell vein in the leased portion of its holdings. The report claims that the Marsh has [illegible] of the famous Lucky Boy Pittsburg vein, which has yielded millions of dollars, and concludes with the statement that "in addition to the information contained herein another situation has developed recently that may add materially to the value of the company property". The lease of the Marsh on the Russel claim lacks nearly seven years of expiration. According to rumors in general circulation the Russel vein has been yielding a large tonnage of rich lead-silver ore to the Hecla Mining Co. It is averred that the Marsh lays claim to the apex of this vein and to all of the ores removed.

NEVADA

Reno.—The following letter has been received from H. M. Rives, secretary of the Nevada Mine Operators' Association:

"An erroneous impression prevails that wages have been increased in the Tonopah and Divide districts. This is incorrect, the wage-scale existing on August 1 remaining unchanged. Tonopah and Divide operators have granted a bonus of 50c. per day for each occupation, to prevail until a commissary is established. It is expected that this will function within sixty days, after which the bonus will be withdrawn.

"Because injury may result from the circulation of rumors that the Tonopah and Divide wage-scale has been increased, the mine operators' association of those districts have requested that you be informed of the facts. Copies of the agreement entered into between employers and employees and a letter transmitted by the Tonopah and Divide Mine Operators' Association to its members are enclosed."

The letter from the Tonopah and Divide Mine Operators' Association to its members is in part as follows:

"It is the opinion of the Executive Committee that two checks should be issued to each employee, one check covering the regular payment of so many days' labor at a certain rate, and the other check covering so many shifts' bonus at 50c. per shift. It is also suggested by the Executive Committee that the bonus check be plainly marked on the face thereof, so there will be no misunderstanding about same. A good many of the companies are making settlements at this time for the retroactive feature of the agreement up to November 1. The 50-cent bonus from that time on will be paid by separate check on the regular pay-days."

The Agreement follows in full:

Agreement between Tonopah and Divide Mine Operators' Association and Tonopah Trades Association. Tonopah and Divide Mine and Mill Workers' Organization.

Dated November 7, 1919.

First—The operators agree to establish a commissary within sixty days of the ratification of this agreement, to sell the necessities of life to their employees at cost, plus operating expenses. The employees shall have equal representation on the advisory board whose duty it will be to see that goods are being sold to employees on cost basis and without profit and to act in an advisory capacity with regard to the general policy and operation of the store and to recommend any changes which may in their opinion be made in the interest of harmony and co-operation as between the store and its patrons and for the benefit of employees.

Second—Coal shall be sold and delivered to all employees at cost.

Third—Operators will grant a bonus to all employees of fifty (50c.) per shift retroactive to the time the individual employee returned to work, provided such employee is still on the poyroll.

Fourth—At the end of sixty days from the ratification of this agreement a Federal mediator will be called in who shall be instructed and have an agreement with both parties of this agreement to the effect that in case he finds the commissary at that time is functioning fully and delivering all necessities of life at cost, he will so declare and the bonus above mentioned will be withdrawn. Should he find the commissary not functioning fully, he will return each thirty days thereafter until he finds the commissary to be functioning fully and the bonus will be continued in such meantime.

Fifth—Board shall be given to single men at thirty-seven dollars and fifty cents ($37.50) per month where boarding-houses are now hereafter operated by companies. Goods from the store shall be sold to private boarding-house keepers after arrangement with such boarding-house keepers has been made to the end that they furnish board to employees at $37.50 per month. This clause to become effective at the time store becomes fully operative and bonus withdrawn.

Sixth—Agreement to be in effect until August 15, 1920.

Tonopah and Divide Mine Operators' Association.

By ALLIENE CASE, Chairman.

ALLEN RIVES, Secretary.

Tonopah and Divide Mine and Mill Workers' Association.

By HENRY R. BREWSTER, Chairman
W. J. LEARY,
JOHN LEARY,
D. D. McMILLAN,
B. J. BRYNE, President.

Austin.—According to reports received by local mining men, the high-grade Cahill vein has been intersected at a depth of 180 ft. in the Nevada Birch Creek mine. The property lies in the Birch Creek district, 12 miles from Austin. The Cahill Lode Co. is rushing developments on the South Extension group to open the continuation of the Cahill vein, and the tunnel is expected to reach its objective in the near future. From its North Extension property, adjoining the Nevada Birch group on the north, the company is preparing to ship high-grade gold ore to custom plants.

Birch Creek.—The upper tunnel at Nevada Birch Creek has penetrated the Cahill lode for 75 ft. showing quartz and stringers of rich ore. Seams assaying $50 to $51,000 are exposed. A second tunnel has been driven 240 ft. and is expected to tap the orebody at a depth of 150 ft. At this point rich ore in commercial quantities is anticipated.——Cahill Lode Co. has started sinking a double-compartment shaft to reach the Cahill vein on the South Extension group beneath the porphyritic capping. The shaft is going down between two points where gold has been found on eroded sections of the property.

Goldfield.—Ore assaying around $30 per ton is showing in the bottom of the winze at the Cracker Jack, approximately 440 ft. from the surface. North and south drifts from the raise above the cross-cut on the 440-ft. level have opened full faces of $10 to $25 ore, with the average running about $18. Driving the cross-cut has been resumed.

Pioche.—The Stindt-Donahue lease on the Big Five has opened a body of high-grade galena adjacent to the Pitts shaft. The orebody is two feet wide and accompanied by carbonate material of shipping grade. Sinking the Blacksmith Shop shaft from 140 to 200 ft. is progressing. The lessees are planning to ship a carload of ore each week to Utah plants.——Hames Bros. are shipping from their lease on the Currency mine of the Amalgamated Pioche. The ore is largely silver-lead but shows some free gold.——Lee

Battles and A. W. Johnson are shipping from their lease on the Bristol group of the Uvada Copper Company.

Virginia City.—New work in the Consolidated Virginia mine is approaching the old and rich section of the property, which was closed down because of a disastrous fire 30 years ago. The area has never been mined since that time, and is stated to have been yielding high-grade silver-gold ore at the time the fire broke out. A new orebody, eight feet wide and assaying around $16 per ton in silver, has been uncovered near surface on the Southwest Comstock Extension group. The vein was found near the portal of a new tunnel being driven to cut the Roberts vein, 75 ft. distant. As soon as the vein is tapped a 100-ft. shaft will be sunk on the rich vein and deep development undertaken.

OREGON

Sumpter.—The United Gold Mining Co., operating on the Independence mine, 17 miles south-east of Sumpter, has cut the orebody on the deep tunnel level and drifted upon it in both directions from the cross-cut for a total of several hundred feet, according to Arthur B. Lee, president, Spokane. The mill is being operated on three shifts and is receiving 50 tons of ore daily, which will be the rate until the development of the mine is extended.

BRITISH COLUMBIA

Kaslo.—The Flint mine on the south fork of Kaslo creek has been purchased by Elmer J. Edwards and others of Spokane from James Carter of Kaslo. The new owners expect to ship a car of ore about December 1.

Sandon.—This district, the premier silver-lead camp of the early days, is the most active in the Kootenai, and many believe that its future in the matter of production will eclipse its spectacular past. In the matter of deep development the leading properties of the region illustrate the principles of large-scale mining, and many of the best orebodies now being stoped are in properties that have been longest worked. It is estimated that there are 400 men working in the mines and mills of the district, including the Alamo concentrator. Five mines are producing ore for Clarence Cunningham, the largest individual operator.

Slocan.—Intersecting rich ore in its south drift, in which work was started only three weeks ago, operators of the McAllister mine on the north fork of Carpenter creek have now tapped at depth high-grade orebodies on both sides of the canyon or glacial cut that bisects the property. Some of the ore in the face is said to run 1000 oz. of silver per ton, and averages more than 100 oz. for a width of three feet.

Trail.—Reports from the smelter of the Consolidated Mining & Smelting Co. show new properties coming into the shipping list. In the last 10 days of October 4897 tons of ore was received from 28 mines and prospects, two of which are on the list for the first time this year. The two are the Cavanaugh of Trout lake with 20 tons and the Ten Day Man of Adamont with 16 tons. Five mines in Washington are on the list. They are the Consolidated mines, shipping 35 tons from Clines station in Stevens county; Reardan mines, Clines, 30 tons; Loon Lake Copper, Stevens county, 33 tons; Lone Pine-Surprise, Republic, 63 tons; and Quilp, Republic, 245 tons. Other tonnage is as follows: Centre Star, Rossland, 1422; Josie, Rossland, 845; Duncan, Beaverdell, 16; May Reynolds, Nicola, 42; Union, Lynch Creek, 49; Eastmount, Enterprise, 33; Echo, Silverton, 104; Florence Silver, Ainsworth, 186; Queen Ross, Alamo, 43; Ruth, Ainsworth, 57; Rambler-Cariboo, Slocan, 105; Standard, Silverton, 355; Tariff, Ainsworth, 6; Whitewater, Retallack, 59; North Star, Kimberley, 306; Paradise, Athalmer, 89; Monarch, Field, 81; St. Eugene, Moyie, 76; Iron Mask, Kamloops, 128; and Mandy, Le Pas, Manitoba, 406.

Personal

The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

Charles Butters is in New York.

Scott Turner is at Vancouver, B. C.

Robert Nye is at Gilman, Colorado.

Ritaro Hirota will sail from Seattle for Tokyo on November 24.

W. A. Wolf has left Ecuador for an extended visit to the United States.

J. Power Hutchins is at Rome, and will remain in Italy to the end of the year.

W. A. Meloche has returned from Stewart, B. C., and is now at Jerome, Arizona.

Stanly A. Easton, manager for the Bunker Hill & Sullivan Mining Co., was at Butte last week.

Arthur Winslow, of Boston, was in San Francisco this week. He is now at Telluride, Colorado.

Courtenay De Kalb was delayed in Spain and did not sail from Brest to New York until November 15.

A. H. Godbe, president of the Prince Con. M. & S. Co., has returned to Salt Lake City after a trip to New York.

L. S. Cates has returned to his headquarters at Salt Lake City after a visit to the Ray Consolidated properties in Arizona.

E. W. Engelmann, consulting flotation engineer for the Jackling properties, has returned to Salt Lake City from New York.

T. A. Janney, superintendent of the Arthur plant of the Utah Copper Co., has returned to Garfield, Utah, after a month's visit in New York.

Ferdinand P. Egeberg, a distinguished Norwegian engineer, is at Salt Lake City, on his way to Arizona, where he will study methods of flotation.

J. Benjamin Parker, metallurgist, of Salt Lake City, has accepted a position as flotation engineer with the Interstate-Callahan Mining Co. at Wallace, Idaho.

W. Lester Mangum, vice-president of the various Jesse Knight mining interests in the Tintic district, Utah, has returned to Provo, Utah, after an Eastern trip.

D. D. Moffat, consulting engineer of mills for the Jackling porphyry properties, is making an inspection of the Chino and Ray milling-plants in New Mexico and Arizona.

Wilford Van Waggonen, general manager for the Sunset Mining Co. at Leadore, Idaho, and **G. W. Wood,** mine engineer for the same company, were at Salt Lake City recently.

H. Lidson Hancock, general manager for the Wallaroo & Moonta company, with headquarters at Adelaide, South Australia, has been visiting mines and metallurgical plants in Utah.

R. N. Hunt, James F. Kemp, Reno Sales, C. K. Leith, Alexander N. Winchell, and **Horace Winchell** testified for the Utah Consolidated in the case now being heard at Salt Lake City, and **A. C. Lawson, Waldemar Lindgren, Albert Burch, O. P. Peterson,** and **George D. Blood** for the Utah-Apex Mining Company.

Alexander H. Smith has returned after three and a half years service with the Canadian Expeditionary Force in France and Belgium. On demobilization he has been placed on the Reserve of Officers with the rank of Major of Engineers. He is at present retained to look after the re-establishment of the disabled and youths that joined the colors before reaching the age of 18. He has started a class of 20 men taking a special course in mining and milling at the Haileybury Mining School, Ontario.

THE METAL MARKET

METAL PRICES

San Francisco, November 18

Aluminum dust, cents per pound	60
Antimony, cents per pound	9 50
Copper, electrolytic, cents per pound	21 00—22 00
Lead, pig, cents per pound	7 00—8 00
Platinum, pure, per ounce	$140
Platinum, 10% iridium, per ounce	$160
Quicksilver, per flask of 76 lb.	$80
Spelter, cents per pound	9 50
Zinc dust, cents per pound	11 00—13 50

EASTERN METAL MARKET

(By wire from New York)

November 18.—Copper is inactive and weak. Lead is quiet and firm. Zinc is dull and steady.

SILVER

Below are given official or ticker quotations in cents per ounce of silver 999 fine. From April 23, 1918, the United States government paid $1 per ounce for all silver purchased by it, fixing a maximum of $1.01½ on August 15, 1918, and was continued to pay $1 until the quantity specified under the Act is purchased, probably extending over several years. On May 5, 1919, all restrictions on the metal were removed, resulting in fluctuations. During the restricted period, the British government fixed the maximum price for bars (the last being at March 31, 1919) on account of the low rate of sterling exchange, but removed all restrictions on May 10. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), converted at the normal rate of exchange.

		New York cents	London pence			New York cents	London pence
Nov.	12	126 50	69 00	Oct.	7	119.56	63.71
"	13	126 50	69 00	"	14	117 44	62 83
"	14	126 87	68 00	"	21	117 95	63 98
"	15	124.75	67.75	"	28	119 37	64 45
	16 Sunday			Nov.	4	122.20	66 16
"	17	124 00	69 00	"	11	123 32	67.22
"	18	125 75	70 00	"	18	125 73	68.81

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	75 14	88.72	101.12	July	78.92	99 62	106 36
Feb.	77 54	85 79	101.12	Aug.	85 40	100 31	111.35
Mch.	74 13	88 11	101.12	Sept.	100 73	101.12	113.92
Apr.	72 51	95 35	101.12	Oct.	87.38	101 12	119.10
May	74 61	99 50	107.23	Nov.	85 97	101.12	....
June	76 44	99.50	110.50	Dec.	85 97	101.12	...

COPPER

Prices of electrolytic in New York, in cents per pound.

Date			Average week ending		
Nov.	12	21 25	Oct.	7	21 35
"	13	21.20	"	14	21.72
"	14	21 75	"	21	21.87
"	15	21.50	"	28	21.75
"	16 Sunday		Nov.	4	21.37
"	17	21.25	"	11	21.10
"	18	21.20	"	18	21.36

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	29 53	23 50	20 43	July	29 67	26.00	20.82
Feb.	34 57	23 50	17 34	Aug.	27 42	26 00	22.51
Mch.	36 00	23 50	15.05	Sept.	25 11	26 00	22.10
Apr.	33 16	23 50	15 23	Oct.	23.50	26 00	21.66
May	31 69	23 50	15 91	Nov.	23.50	26.00	...
June	32 57	23.50	17.53	Dec.	23.50	26.00	....

LEAD

Lead is quoted in cents per pound New York delivery.

Date			Average week ending		
Nov.	12	6 80	Oct.	7	6 16
"	13	6 80	"	14	6 25
"	14	6 80	"	21	6.43
"	15	6 80	"	28	6.66
	16 Sunday		Nov.	4	6.75
"	17	6 80	"	11	6.75
"	18	6 80	"	18	6.80

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	7 64	6 85	5 60	July	10 93	8.03	5 53
Feb.	9.10	7.07	5 13	Aug.	10.75	8 05	5.78
Mch.	10 07	7 26	5 24	Sept.	9.07	8 05	6 02
Apr.	9.38	6 99	5 05	Oct.	6.97	8.05	6.40
May	10.29	6 88	5 04	Nov.	6.38	8.05	....
June	11.74	7.59	5.32	Dec.	6.49	6.90	....

TIN

Prices in New York, in cents per pound:

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	44.10	85 13	71.50	July	62 60	93 00	70.11
Feb.	51.47	85 00	72 44	Aug.	62.53	91 33	69.20
Mch.	54.27	85 00	72.50	Sept.	61.54	80.40	55.79
Apr.	55 63	88 53	72 50	Oct.	62 24	78 82	54 82
May	63 21	100 01	72.50	Nov.	74.18	73.67	....
June	61 93	91 00	71 83	Dec.	85 00	71.52	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery in cents per pound:

Date			Average week ending		
Nov.	12	8 10	Oct.	7	7.40
"	13	8.25	"	14	7.75
"	14	8.35	"	21	7.89
"	15	8.35	"	28	8 10
	16 Sunday		Nov.	4	7 92
"	17	8.30	"	11	7 97
"	18	8.30	"	18	8.28

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	9.75	7.78	7.44	July	8.98	8 72	7 78
Feb.	10.45	7.97	6.71	Aug.	8.88	8.78	7 81
Mch.	10.78	7.87	6.53	Sept.	8 33	9.58	7.57
Apr.	10 20	7.04	6.19	Oct.	8 62	9 11	7 82
May	9 41	7.92	6 43	Nov.	7.76	8.75	....
June	9 63	7.92	6.91	Dec.	7 84	8.49	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. Prices, in dollars per flask of 75 pounds:

Date					
Oct.	21	80.00	Nov.	4	80 00
"	28	85.00	"	10	80 00
			"	18	80.00

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	81 00	128 06	103.75	July	102 00	120 00	100.00
Feb.	126.25	118.00	90.00	Aug.	115.00	120 00	103 00
Mch.	113.75	112 00	72.80	Sept.	112.00	120 00	104 60
Apr.	114 50	115 00	73.12	Oct.	102 00	120 00	86 00
May	104 00	110 00	84.80	Nov.	102.50	120 00	
June	85.00	112.00	94.40	Dec.	117.42	115 00	

MONEY AND EXCHANGE

A Barton Hepburn, chairman of the advisory board of the Chase National Bank, states that the only possible policy for the restoration of Europe to normal conditions is economy and thrift. Discussing present rates of foreign exchange and some of the difficulties in the way of relieving the difficult situation, he said in part as follows:

"Let me quote Governor Harding of the Federal Reserve Board, who says: 'It is the view of the Federal Reserve Board that the need of Europe is for long credits, and that the situation, therefore, is one which appeals to the investment market.' The federal reserve bank law provides that paper discounted by the Federal Reserve Bank shall not run longer than 90 days, except agricultural paper and paper secured by livestock, which may run six months. It is apparent that the Federal Reserve Bank can afford no relief to Europe under the circumstances. It is equally apparent that banks of discount and deposit in this country, in other words, commercial banks, can afford no relief to Europe. While the law may not limit the length of maturity which they may take, custom, conservatism, and good sound banking do limit their maturities. Anything that they would take for longer maturity periods would not be available for re-discount with the Federal Reserve Bank. Temporary credits may be extended to Europe and are being extended predicated upon current transactions, which credits are expected to be liquidated within the usual period of the commercial bank transaction.

"Most of the current newspaper comment upon the exchange situation is quite absurd. They want European exchange restored to par. That would involve restoring the depreciated currencies of Italy, France, and England and many other countries to a parity with our currency, which is redeemable in gold. The only way that can be accomplished is to have these nations fund their indebtedness, enter upon a vigorous period of industrial activity and economy, and bring their nations back to the gold standard. That is a Herculean task and will involve many years.

"It would be quite possible to bring about a parity of exchange by foolish investments on the part of America, either through our Government or individually or through banks, which would put off the gold standard and depreciate our currency to a par with that of Europe. No one wants such a result, and yet to follow the advice of those people who are so frequently rushing into print with the insistence that we must loan Europe billions would have no other result. There are individual enterprises in all these European countries worthy of confidence and credit. These will be singled out, the usual credit tests applied, and their wants supplied; and in this way Europe will be financed to the extent that it ought to be.

"The debt of Great Britain is still increasing. Their current taxation does not equal present expenditures. The same is true in an emphasized degree of France and of Italy, and all sorts of financial schemes ranging from a capital tax to repudiation, will fill the air and make the holders of certain foreign government securities more or less uneasy for some time to come. This country is confronted, in a modified degree, with the same problems that confront Europe. Money is in strong demand at full rates. There is no surplus of unemployed available for use abroad, and inflation, seemingly is the only source from which large sums could be made available for financing Europe."

Quotations on November 18 are as follows:

Sterling:	Cable	4 07 ¾
	Demand	4.07
France:	Cable	9 60
	Demand	9.58
Lire:	Demand	11 80
Marks		2.95

Eastern Metal Market

New York, November 12.

The markets are dominated by the effect of the coal strike. Though this has been called off, it is not known how soon the miners will again produce coal.

Demand for copper continues light with prices slightly lower.

A fair business has been done in tin. Spot delivery prices are lower because of the end of the longshoremen's strike.

The lead market is firm but quiet and no large demand is reported.

The zinc market is quiet, steady, and slightly higher, though buying is light.

Antimony is a little stronger.

IRON AND STEEL

An early increase in the output of pig-iron and steel is probable as a result of the calling off of the coal strike and the return to work of further large numbers of steel strikers. No cutting down of steel output has resulted from the week of the coal strike. The break in the steel strike has been most marked at Youngstown, Ohio, where workers have returned in larger numbers than at any time since the strike began. In that district 60% of the open-hearth furnaces are operating and 12 out of 25 blast-furnaces. There has been an intensive market for steel-making pig-iron the past week. In Philadelphia 40,000 to 50,000 tons of steel-making iron, largely basic, has been sold at advances of $3 to $5 per ton. In the Pittsburgh district sales have been made at a $2 per ton advance over the March 21 basis. The Pacific Coast shipyards are inquiring for 20,000 to 40,000 tons of plates, shapes, and bars for tank ships to be built there. September exports of iron and steel fell off to 363,000 tons as against 465,000 tons in August. Imports rose to 44,000 tons against 29,000 tons in August.

COPPER

Conditions are practically unchanged. Business is light and it is difficult to arrive at a correct appraisal of the market. All ranges of prices are heard of on the business done or the offers made. Anywhere from 20.50c. to 22.25c., New York, for electrolytic copper, either as offers or sales, are rumored for early delivery. For prompt electrolytic 21c., New York, was offered by sellers on Saturday. The various strikes are interfering with buyers in this market. We quote a fair average of the market as 21.25c., New York, for electrolytic copper for early delivery with Lake at ¼ to ½c. above this. Total sales in October are estimated to have been 125,000,000 lb. of refined copper, with sales for export at about 40,000,000 lb. Japan is still a heavy buyer with England also making sizable purchases of crude copper.

TIN

There has been a moderate business the past week and there is much more optimism. The better feeling is due to two causes: The practical assurance that the coal strike is a failure and also the result of the elections. These events have bolstered up the courage of tin buyers. The fact also that the longshoremen's strike is a matter of the past has been an important factor. It has been believed all the time that the coal strike would fail and the withdrawal of the strike is a bull factor. The better business has been largely in nearby tin. The vessels in the New York harbor having tin aboard are being gradually unloaded and as a result the spot market has fallen. Prices for this position have varied widely on different days, due largely to the inability of the buyer to locate the right sellers. No November 6 early in the day sales were made at 54.50c., with 55.50c. obtained late on the same day. On November 7 the situation was reversed, 54.75c. having been realized early in the day with 53.75c. the sale price late the same day. The market has been steady since then. We quote the market today at 53.75c., New York, for spot tin, New York. Tin for future shipment from the East is held at about 53.25c. On November 7 a fair business was done in future shipment tin. Slowness in the delivery of cablegrams has interfered with business. Thus far this month 850 tons is reported as the arrivals of which 600 tons came in at Pacific ports. The quantity of tin afloat is reported as 5415 tons.

LEAD

The market has been quiet and steady. In some cases premiums have ruled at St. Louis, but at New York the price of the leading interest has been adhered to. We quote the market at 6.50c., St. Louis, or 6.75c., New York. There have been occasional re-sale lots offered under the market. There is no large inquiry visible and demand is confined to carload lots.

ZINC

The future of this market depends to a considerable extent on the ultimate result of the coal strike embroglio. The market has gradually stiffened until today prime Western for early or nearby delivery is quoted at 7.75c., St. Louis, or 8.10c., New York. The firmer market is explained as due not so much to a heavy demand as to the disinclination of sellers to commit themselves for any position until the skies clear. What buying has appeared has largely proceeded from dealers. The general tone of the market is strong and the feeling optimistic in view of the latest strike developments.

ANTIMONY

The market is a little higher at 8.87½c., New York, duty paid, for wholesale lots for early delivery.

ALUMINUM

No change is recorded with wholesale lots of virgin metal, 98 to 99% pure, quoted at 32 to 35c., New York, for early delivery.

ORES

Tungsten: The unfavorable factors, the coal and steel strikes and the tariff matter, continue to dominate the situation. Practically no business has been reported and quotations continue nominal at $7 to $15 per unit in regular concentrates, depending on the grade, delivery, etc. So far as ascertainable in the absence of any business, the nominal quotation for ferro-tungsten is $1.25 per lb. of contained tungsten.

Molybdenum: The market continues quiet with almost no inquiry. Quotations are nominal at about 75c. per lb. of MoS_2 in regular concentrates.

Manganese-Iron Alloys: Carload lots of standard American ferro-manganese have sold at $110, delivered, for delivery this year and into the first quarter, but demand is light. No big business is in sight. British producers are out of the market, supplies of ore in that country being reported low. Spiegeleisen, 19 to 22%, is selling at about $35, furnace, with demand not heavy. Foreign inquiries continue under negotiation.

Shipments of the U. S. Steel Corporation in October were about 60% of finished mill production capacity. With an unfilled tonnage gain of 188,030 tons, the corporation booked close to 1,000,000 tons in this period.

ONE of our local organs of misinformation mentions Karl Marx and identifies him as "a German who is dead". If ever a Banquo spoiled a feast, it is the ghost of Karl Marx that gibbers today at American industry.

IN this issue we publish the address delivered by Mr. George Otis Smith, the Director of the U. S. Geological Survey, before the American Mining Congress at St. Louis. Next week we expect to give our readers the address by Mr. Van H. Manning, Director of the U. S. Bureau of Mines. These gentlemen are well qualified to speak for the mining industry in its national aspect and never do so without giving both information and stimulation to those engaged in the work of winning minerals from the earth.

SEVERAL interesting resolutions were brought before the American Mining Congress. One of them was to place a tax of $10 per ounce on all gold used in manufactures and arts, this tax to be collected by the Government and paid to the mine operators. We note that fully 60 million dollars worth of gold has been sold by the New York assay-office this year for strictly commercial purposes, as against total sales of the same kind amounting to $41,000,000 during 1918. A premium for gold exists today and the gentlemen at St. Louis evidently only ask that it be recognized, as it is already in Europe.

OUR 'Discussion' department this week includes a valuable letter on the Horwood process from Mr. William Motherwell, who recently returned from the Kolar goldfield in India. He records his experience with this method of selective flotation in British Columbia and gives just the information that other technical men would like to have. Mr. F. H. Mitchell writes feelingly and bitterly concerning his experience as a claimant under the War Minerals Relief Act and will doubtless find many in the West to sympathize with him. Mr. George McClelland expresses his view concerning State Insurance in California. We do not agree with him, but we are more than willing to give him the opportunity to present his case. The last letter, on the 'Price of Gold', is from Mr. W. D. Pagan, the secretary of the North Star Mines Company.

ACCORDING to the 'New York Times', there were 317 major outbreaks of disorder reported in the Mexican newspapers during 112 days, from April 10 to July 31 of this year. Of the 30 States and Territories into which Mexico is divided, all except Lower California contributed to this orgy of violence and bloodshed. Out of the total, 272 were ascribed to the activities of various factions in rebellion against the Carranza government, 15 to organized banditry, and 15 to the lawlessness of police and military officials. During the same period 72 trains were looted, dynamited, or burned, besides the stations that were attacked and the tracks that were destroyed. Thirty-one towns were raided. These figures give some idea of the conditions prevailing in Mexico. At the present moment the Jenkins affair has created something that is more than a diplomatic crisis. The shooting, after capture, of Felipe Angeles would remove one of the few interesting personalities of the Mexican arena. It appears that he has not been shot as yet, but technically a court martial will be justified in ordering the extreme penalty. How long must we endure the disorderly and unsavory performances in our backyard?

FOREIGN EXCHANGE continues to decline seriously, the extreme weakness that brought the English pound close to the four-dollar mark, with continental rates approaching collapse, being given as one of the causes for the recent break on the New York Stock Exchange. This weakness is having a serious effect on our foreign trade, to appreciate which it is only necessary to realize that with the mark at 2.40 cents Germany would have to pay, in effect, $10 per dozen for eggs bought in this country. No tariff could be so effective in preventing foreign countries from buying here. The remedy that has been generally accepted has been that the United States should extend long-term credits to the European nations, on a scale that would permit them to make purchases in this country in proportion to their needs. There has been considerable agitation by exporters to this end, and current newspaper comment has reinforced their stand. Now comes Mr. A. Barton Hepburn, chairman of the advisory board of the Chase National Bank, who says that this idea is based on a false hypothesis. He states, in substance, that for the United States to loan Europe billions would undoubtedly stabilize foreign exchange, but by depreciating the currency of this country to a par with that of Europe, not by building up European currency to a par with that of this country. Money is in strong demand here at full rates; and without such inflation as would invite disaster there can be no large surplus for use in Europe. The only recourse, says Mr. Hepburn, is for the nations of Europe to "fund their

indebtedness, enter upon a vigorous period of industrial activity and economy, and bring their nations back to the gold standard. That is a Herculean task and will involve many years." This seems true, and it might with equal benefit be applied to the United States, which is letting slip every day, through its orgy of extravagance and demands for less work, the advantageous position in which it was left by the end of the War. We commend Mr. Hepburn's opinions to the thoughtful attention of our readers.

WE have discussed the Treaty and the League of Nations more than once in these columns, so that our views on this deeply important subject are known, and we have no desire to repeat the argument. We venture, however, to record our earnest belief that the failure of the Senate to ratify these solemn agreements, to which our representatives at the Paris Conference placed their signatures, is a calamity for the world and an injury to the United States. The defeat of the Treaty by the Senate is due in part to petty politics, that is, the desire to discipline the President and destroy his work at Paris. In large measure, this opposition to the President's policy springs from his ill-advised letter before the Congressional election of 1918 and his failure to consult with the best men of both our political parties. It is due also to a narrow-minded notion of detaching the United States from international complications in Europe, as if this were not now proved to be impossible. In consequence of the assassination of an Austrian archduke in a Bosnian village we had to send two million soldiers to Europe and spend twenty-five billion dollars in preparing for warfare. No reason exists for believing that we can keep out of the next big war, for, in future, unless some international organization exists for postponement and deliberation, we shall again be drawn, against our will, into the great conflagration. The progress of science has killed our isolation; we are nearer to Europe today than Europe was to England in Napoleon's day. New conditions call for a new adjustment. We have hopes still that the Senate, after adjournment, will take a broader view of the issue and not allow their animosity against the President to commit them to a grand blunder.

EVIDENCE of a revival of British interest in mining speculation multiplies. We note the formation, in London, of an exploration company on a large scale and supported by an unusual array of financial talent. It is called the National Mining Corporation and has a capital of £3,000,000, according to the 'Financial Times'. The directorate includes Mr. Walter McDermott of the Consolidated Mines Selection Company, Mr. J. A. Agnew of the Burma Corporation, Mr. F. A. Govett of the Lake View & Oroya Exploration Company, Mr. F. W. Baker of the Mexican Corporation, Mr. E. S. Christopherson of the Consolidated Gold Fields of South Africa, Mr. B. Kitzinger of the National Bank of South Africa, Mr. H. Strakosch of the Union Corporation, Mr. A. S. Elmore of the Chemical & Metallurgical Corporation, and Mr. H. Guedalla of the Imperial & Foreign Corporation. The 'Financial Times' mentions the fact that Mr. Kitzinger is a naturalized German and Mr. Strakosch a naturalized Austrian. It is expected that Mr. Baker will be managing director, together with Mr. E. Kitson. Two-thirds of the capital has been subscribed by the participating companies, the other third being offered to the public. This aggregation of financial groups is interesting in that it crystallizes the tendency, manifest during the last decade, of a co-operation among the mining groups, with a view to diminishing such competition among them as encourages the over-valuation of the mines offered on the London market. It is questionable whether it will add to the prestige of London as a market for mines, but it will facilitate the raising of money for such as are sold there. We doubt also whether this concentration of enterprise will help the profession; on the contrary, it may, we think, diminish the opportunities of engagement or of retainer open to engineers, by affording them a giant client in lieu of a number of less financial weight. In this country the organization of big corporations, elbowing the smaller ones almost out of existence, has not proved beneficial to the profession. It has created a few over-paid appointments for a small number of successful men and rendered the independent engineer's position increasingly difficult. We think the profession was better off twenty-five years ago when the big corporations were not so dominating and a relatively larger number of clients were available to the mining engineer.

Incorporate the Unions

Among the measures to be taken for preventing the disorder, physical and industrial, inseparable from strikes, it has been suggested that the labor-unions should be compelled to incorporate themselves, in order to justify their reasonable claims to collective bargaining. The proposal is not new; we have advocated it in these pages more than once; more influential persons have done so elsewhere. With the attempt to debar ordinary strikes, that is, to outlaw the concerted decision of the employees not to work on terms that seem unfair, we have no sympathy. The owners of a manufacturing plant retain the 'right' to close their works without consulting their employees; we see no reason why the reciprocal 'right' should not be recognized, provided always that it does not go so far as to bring hardship on the community as a whole, in which case both employer and employee must pause and consider how far their supposed 'rights' trespass on the paramount welfare of society. At present the chief objection to collective bargaining, which is now an established custom, arises from the irresponsibility of the unions, which are mobilized and demobilized to suit the occasion, in cynical disregard of all those sanctities of good faith that are involved in agreements. It does not seem fair that the unions should have the privileges of corporate institutions, namely, recognition as industrial units and the opportunity of collective bargaining, without assuming the legal obligations implicit in corporate organization. At present the

employers' corporation is liable to judgment for damages in case of breaking a contract with its employees; it has property that affords security for the fulfilment of its agreements; it is amenable to the law. On the other hand, the labor organization is here today and gone tomorrow; its leadership is changed according to the exigencies of the industrial dispute; it is in a state of flux, without tangible property or fixed personnel; it represents the extreme phase of irresponsibility, and illustrates completely Thurlow's epigram on the corporation: "It has no soul to be damned and no body to be kicked." This irresponsibility plays into the hands of the disorderly element that is present in most aggregations of men, in boards of directors as well as in labor committees; it detracts from the social recognition for which the union strives; to it is due the lack of confidence that undermines the contracts made between employers and their employees. It creates a one-sided arrangement fatal to industrial stability. Once incorporated, the labor-union would leave the employing corporation no excuse for refusing to bargain with it and both would feel some sense of security in any agreement made between them. Both corporations, that of capital and that of labor, would be alike amenable to the law against conspiring in restraint of trade and both could be made to answer for acts of social sabotage. With the legal recognition of the labor-union and its acceptance of legal responsibilities would come a better understanding, and a larger measure of that respect necessary to the co-operation of labor with capital. Without this legal responsibility, the labor-union is frequently only a conspiracy to hold-up the employer, and, if that fails, to victimize the entire community, instead of being, as it can be, a democratic organization for the maintenance of that economic balance so essential to the stability and prosperity of the industrial organism.

The Burma Mine

One of the great mines of the world is the Bawdwin, the property of the Burma Corporation in the Northern Shan States of Upper Burma. It is interesting to Americans because, among other reasons, it was opened up by Mr. W. J. Loring, of California, for the British engineering firm of Bewick, Moreing & Co., and later developed more intensively and successfully under the direction of Mr. Herbert C. Hoover. The story of this venture illustrates the vicissitudes not uncommon in mining enterprise. In 1904 Mr. M. F. Kindersley organized the Great Eastern Mining Co. in Burma to acquire a group of ancient silver-lead mines and slag-dumps near Lashio, about 50 miles south of the Chinese frontier. The property covered 2496 acres and was held under license from the government of India. In 1906 this company sold its rights to the Burma Mines, Railway & Smelting Co., which was registered in London, after favorable reports had been received from W. A. Freymouth, F. D. Chase, and C. S. Herzig, the first of these engineers representing Sulman & Picard, and the last, Bewick, Moreing & Co. In 1908 the name of the company was changed to Burma Mines, Limited. At that time there was no immediate intention of working the mine, which consisted of a large open-cut and other old workings half-smothered by the jungle, but only to treat the accumulation of slag left by the Chinese, whose operations went back four centuries. They ceased operations in 1851, at the time of the Mohammedan uprising, after which the Burmese did some work, but not much. An accumulation of 115,000 tons of rich slag was available for smelting, so the first step taken was to erect a lead smelter at Mandalay, 169 miles from Bawdwin. A narrow-gauge railway 50 miles long had to be built to carry the slag to the junction with the Burmese railway system. Smelting began in February 1909, but the operation proved unprofitable on account of the cost and difficulties of transport over a badly-constructed railroad. During that year 5029 tons of lead and 26,398 oz. of silver were produced. In 1910 the smelter treated 18,772 tons of slag, averaging 46% lead and 1.8 oz. silver, together with 500 tons of ore from the mine. Evidently the Chinese discarded the lead, and saved the silver alone. The cost of transport was $43,007, so that only an operating profit of £3094 was made. At this time a little preliminary work was done at the mine and high-grade ore was found in the old pillars and stopes. It appeared that the Chinese had worked some of the sulphide ore, as well as the carbonate. In 1911 the smelter was moved to Namtu, 12 miles from the mine, and a refinery was added to the plant, so as to sell the lead in the Orient. Exploratory work at the mine was continued. In 1912 the company operated at a loss of £14,911, despite the production of 8564 tons of lead bullion. During 1913 the Chinaman lode was opened up, disclosing a large orebody assaying 20 oz. silver per ton, with 25% lead and 26% zinc. No dividends had been paid up to this time and successive steps had been taken to raise fresh capital, including an issue of £215,000 in 6% debentures, on top of the original capital, £309,993, in ordinary shares. We do not give the figures in dollars, because the rate of exchange today is different and variable. By this time the slag-dumps were becoming exhausted and deeper exploration of the mine was being hindered by an excess of water, so that the driving of a drainage-adit became imperative. The company was in a bad way financially and needed re-organization.

In October 1913 the Burma Corporation acquired the control of the Burma Mines company, and agreed to furnish £50,000 for working capital, this being increased in May 1914 by a share-issue yielding £100,000 more, and an arrangement to provide a further sum of £200,000 if necessary. Much of this money was provided by Mr. R. Tilden Smith, acting under the guidance of Mr. Herbert Hoover, who had formed a highly favorable opinion of the mine, and became chairman of the new company. The share-issue was successful and work proceeded confidently under the guidance of a technical committee consisting of Messrs. R. Gilman Brown, Theodore J. Hoover, A. F. Keene, and E. Heberlein. The drainage-adit, called the Chinaman tunnel, had followed the lode on a level 171 feet below the surface and near the bottom of the old

workings, which reached to 211 feet, it penetrated a large mass of complex sulphide ore, resembling that of Broken Hill in Australia and of the Sullivan mine in British Columbia. The orebody was 500 feet long and 44½ feet wide, assaying 29.6% zinc, 26% lead, and 23.6 oz. silver. A deeper adit, called the Tiger tunnel, was started to cut the lode 490 feet below the Chinaman adit. Some of this complex ore was sold in Europe, pending the erection of a concentration plant; meanwhile the picked lead ore went to the smelter at Namtu. At the end of 1915 Mr. Tilden Smith stated that a total sum exceeding £2,000,000 had been spent in equipment and development, and of this sum one-half had been derived from the smelting operations. It was estimated that 1,154,000 tons of ore was assured, with the prospect of 500,000 tons more for each 100 feet in depth on the ore-shoots then disclosed. The ore assayed £11 to £14 per ton, but it gave a net profit at that time of £2 to £3 only. During the War only selected silver-lead ore was smelted, pending experiments in the treatment of the zinky ore. In the first half of 1915 the company produced monthly 457 tons of refined lead. On September 25, 1916, the Tiger adit reached the lode at 7333 feet from the portal; and in December a silver refinery was completed, all the silver being marketed thenceforth in India.

Early in 1916 Mr. Hoover resigned as chairman, owing to his war work, and in 1918 he resigned from the board of directors. Sir Trevredyn R. Wynne, who had been president of the Indian Railway Board, became chairman, this change coinciding with a loan of £200,000 made by the government of India and an extension of the company's mining lease for 30 years more, at a royalty of 2½% on 30% of the gross value of the ore as delivered at surface. In 1917 it was decided also to erect a plant in India for the purpose of smelting the zinc ore, and to produce therefrom 30,000 tons of sulphuric acid and 10,000 tons of zinc per annum, this new enterprise to be conducted in association with the celebrated Tata steel works, thereby ensuring an immediate market for the zinc sheets, galvanized iron, and brass. The technical committee was retired, Mr. A. F. Keene being retained as consulting engineer. On June 30, 1917, the assured ore was estimated at 3,793,000 tons, assaying 27.9% lead, 20.7% zinc, 0.5% copper, and 25.7 oz. silver per ton. A concentration plant of 800 tons capacity was purchased in the United States. Tests showed that 65% of the zinc could be recovered in a 45% concentrate. In 1918 Mr. Lawrence Addicks was engaged as consulting engineer; he estimated that by suitable concentration, including flotation, it would be practicable to market 80% of the lead, 70% of the silver, and 45% of the zinc in the ore. On the Tiger adit-level a horizontal area amounting to 23,904 square feet of ore was proved, this ore assaying 34.4% lead, 15.8% zinc, and 29.7 oz. silver. The latest annual report, for 1918, shows total receipts of £1,008,244, against which is set £591,277 for operating expenses in Burma and £139,993 for depreciation, development, general expenses, and other items, leaving £276,973, from which £35,000 is deducted for income-tax and £181,480 is provided for capital expenditure, so that only £60,493 is carried forward as profit. During the year 18,641 tons of lead and 1,970,614 oz. of silver were produced. At the end of 1918 the ore-reserves were stated to be 4,404,000 tons, assaying 26.2% lead, 18.4% zinc, and 24.1 oz. silver. In addition, an orebody in the Shan lode shows 283,000 tons assaying 14.2% lead, 8.7% zinc, 21.6 oz. silver, and 10.2% copper. There is reason to believe that the orebodies northward will be rich in copper. It is noteworthy that the average assays of successive estimates of the ore in this mine show a nearly constant percentage of lead, an increase in silver, and an encouraging decrease in zinc. There is no indication as yet of any impoverishment in depth; on the contrary, the best showing seems to be in the bottom of the mine. The lode follows a zone of fracture in beds of feldspathic grit lying against a foot-wall of rhyolite. No evidence of secondary enrichment has been noted. On the advice of Mr. Addicks, it has been decided to erect at Namtu a new lead-smelting plant capable of producing 60,000 tons of lead and 5,000,000 oz. of silver per annum. Mr. R. G. Hall, formerly in Missouri, is resident manager; he succeeded Mr. C. H. Macnutt, who resigned in 1916 and served with the Engineer Corps of the Canadian army in France. Mr. L. J. Mayreis is manager of the Indian plant. At the annual meeting a reference was made to the intended application of the new Elmore process and to a profit of £11 per ton on the ore by such metallurgical treatment. It is now proposed to form a company—of 18,000,000 shares of 10 rupees—in India to take over the Bawdwin mines, thereby obtaining the further favor of the Indian government, but the exact purpose of the transfer is not made clear and we doubt whether it will increase the confidence of the public in the enterprise, which as yet has not paid a dividend, although the shares have been quoted recently at £11½, making the market valuation £11,500,000. The income-tax on dividends is 30% and the profit-tax 80% on profits in excess of 15%. Transfer to India will not diminish taxation; it will only complicate it. Although this enterprise is now 15 years old, it has not yet reached fruition, despite the expenditure of about £3,000,000 in exploration, development, and equipment, besides the application of a vast amount of technical skill, particularly to the metallurgical problem. This, we believe, is now pretty well solved, so that the shareholders should soon receive something more than estimates, statistics, and reports. The proved ore contains 106,291,000 ounces of silver, 1,154,100 tons of lead, 810,200 tons of zinc, and 44,780 tons of copper, the aggregate assay-value of these metal contents reaching a total of more than £100,000,000, out of which a handsome return should be forthcoming to the shareholders, even after the tax-collector has made his raid on the profits and dividends. The lack of information concerning the cost and character of the metallurgical treatment, together with the uncertain incidence of taxation, make it impossible for us to estimate the present value of the mine, but we shall look forward with keen interest to the fruition of this splendid enterprise.

Selective Flotation by the Horwood Process

The Editor:

Sir—I have read with much interest Mr. Heller's very complete description* of his experience with this process, and if anyone deserves success, surely the owners of the Afterthought mine do.

In the course of a discussion, in 'Metallurgical and Chemical Engineering' on 'The Complex Ore Problem' in 1914 I pointed out the financial advantage being gained by the Zinc Corporation in Australia by the use of the Horwood process, and since then I have been looking for an opportunity to demonstrate its possibilities. When in British Columbia in 1916 I found a man with a problem that had remained unsolved for ten years, and, what was more strange for B. C., he was willing to pay for advice.

His mine is really a pyrrhotite-mispickel mine with about 4% of lead, a little zinc, no copper, and no silver. Some years ago a plant was built to recover the zinc by magnetic separation, but it was not a success. The ore is crushed and concentrated by jigs and tables, and the galena shipped to the smelter. The table-middling, which is mostly pyrrhotite and mispickel, carries about 9% zinc in the form of marmatite (black jack), and the problem is to get this zinc into a marketable concentrate at a profit. It cannot be done by tabling, but might be done by flotation or magnetic separation. Among other methods, I tried the Horwood process in the laboratory and found plenty of difficulties in the way, as I have no doubt Mr. Heller and his staff found at the Afterthought. Neither before nor since that time have I heard of any place where the process is being used on this mixture of minerals, so I had nothing to guide me. In the 'Mining and Scientific Press' of December 23, 1916, there is a letter from Leadville stating that at the Wilson mill at Robinson a new process had been installed by William B. Brooks in which the zinc-iron middling is roasted in Dewey roasters, then separated by flotation, but I have no further information about it and do not know whether it was commercially successful and whether it is still in operation.

My chief trouble in British Columbia was, of course, the roasting. The material contained about 40% iron, 9% zinc, and no copper, as compared with 18% iron, 30% zinc, and 6% copper at the Afterthought. It is fairly coarse and requires grinding to make it fit for flotation, thus differing from magnetic separation. To treat this material by the Horwood process, it should be ground before it is roasted, otherwise in grinding the oxidized surface would be removed and fresh sulphide would be exposed and the pyrrhotite and mispickel would float as well as the blende, yielding a low-grade concentrate unfit for shipping. In actual practice on this material it would be better to grind it in a dry ball-mill with peripheral discharge as used in Australia and at the Golden Cycle mill, in Colorado, to save drying again before roasting; so in the laboratory experiments it was ground in a disc-pulverizer. By using this method there was no chance to add the flotation oil to the ball-mill, so the advantage of doing so was lost.

The material under treatment was roasted in dishes in an ordinary assay-muffle and stirred with a piece of bent wire. It was not easy to stir the material so that all the pyrrhotite and mispickel would get an oxidized, and not merely sulphatized, coating. An ordinary thermometer, reading up to 680°F. was used to take the temperatures. It was found that, to get the best results, the loss of weight in roasting should not exceed 1.5%. The best temperature probably is between 650° and 700°F. It was difficult to ascertain the actual temperature with the apparatus available—the color of the muffle and of the roasted ore being found the best guide—and the temperature was liable to rise suddenly owing to oxidation or 'firing' of one of the minerals present, probably the mispickel, that is, the ore became hotter than the muffle. In roasting an ore or concentrate containing marmatite there is danger of oxidizing the iron constituent of the blende, thereby preventing the floating of the blende. Regarding the difficulty of controlling the temperature during roasting, some interesting experiments were made by roasting the three minerals separately at different temperatures and then testing their floatability. Also by roasting a mixture of the minerals at different temperatures in different proportions to find the point at which a sudden rise in temperature takes place, partly sulphatizing the blende and rendering flotation difficult. Incidentally, it was found that at certain temperatures mispickel and this particular blende become magnetic.

Mr. Heller found that, in treating Afterthought concentrate, the roasting temperature should not exceed 920°F. on the hottest hearth. He found that some copper sulphate was formed during roasting and that it was beneficial in preferential flotation of the blende. Probably ferrous sulphate was also formed. Mr. Heller says that, in preferential flotation, certain oils were used that did not require heat or acid to be *added* to the solution.

*'The Horwood Process as Applied to the Copper Zinc Ore of the Afterthought Mine', by A. H. Heller, M. & S. P., Aug. 2, 1919.

At the same time I understand, from his description, that flotation actually took place in an acid solution, which probably accounts for the good grade of the zinc-concentrate produced, assuming the blende to be marmatite. With resin-blende, of course, a much higher grade of concentrate can be obtained.

In my case ferrous sulphate or some similar salt was formed, making the flotation solution acid and proving detrimental unless removed or the solution neutralized by alkali. In some tests the roasted ore was washed before flotation, and in others lime, caustic soda, or carbonate of soda was added to the solution. If this were not done, the recovery was poor but the concentrate high-grade. On the other hand, I got some pure blende from the mine, ground it to pass 60-mesh, placed it in a bottle with water, a little oil, and some $FeSO_4$ and shook it up. Most of the blende floated, even after the quantity of $FeSO_4$ was largely increased. Of course, it had not been roasted. One gets some apparently contradictory results in experimenting with flotation. Perhaps it was not the $FeSO_4$ that was detrimental. Anyhow, the addition of NaOH improved the recovery but not the grade of concentrate.

The flotation tests were done in a small machine of the Hoover type of M. S. apparatus. It may be that, as in the case of the Afterthought, better results would be obtained with the Janney type of machine. It was found that there was no advantage in heating the water above 60°F. (The natural temperature of the water in winter is a little above freezing point.) By grading and assaying the tailing from flotation tests it was found that the finest grade contained most zinc. I believe that better results would be obtained in actual practice than in the laboratory, because, in roasting, the temperature and stirring can be regulated better.

Some tests were also made with a combination of magnetic separation and selective flotation, but the technical and commercial results did not seem to be as good as with straight Horwood operations.

I formed the opinion that this was a pretty tough proposition, having such poor material to work on, besides the difficulty of treatment, but in February 1917, I reported to the management that I had been able to obtain an extraction of about 70% of the zinc in the form of a concentrate containing from 33 to 42% zinc without 'cleaning'. The ratio of concentration was about 6:1. I figured that by selling the concentrate to the Anaconda company on the tariff then in force, and with zinc at 8 cents per pound, a small profit could be made. This grade of concentrate would not be acceptable to zinc-distillers but the Anaconda company was using the electrolytic process. As the material from which the concentrate would be made was a waste product, I did not charge any of the cost of mining and milling against it, but merely the cost of drying, grinding, roasting, flotation, freight, and treatment. However, owing to lack of money and for other reasons, the company did not do anything further. During 1917 the owners of the Trail smelter erected a large Horwood plant to deal with the dense galena-blende-pyrite ore of the Sullivan mine in East Kootenay, and although I understand it is now closed down, it would be interesting to have their experiences. As far as I know, nothing has been published about it.

There are millions of dollars worth of blende, fine galena, and silver minerals in the Slocan and Kootenay lakes and the creeks flowing into them, much of which could have been saved by adopting better metallurgical methods. The government of British Columbia is now talking of erecting a laboratory in which to experiment on these ores. At the same time one must remember that the nearest market for zinc concentrate was, until 1916, a long way off in the United States, and in addition to freight there was import duty to pay to Uncle Sam.

WILLIAM MOTHERWELL.

San Francisco, November 12.

War Minerals Relief

The Editor:

Sir—In your issue of November 1 information is given that the War Minerals Relief Commission has decided 400 out of the 1200 claims for compensation under the War Minerals Relief Act, and the article is concluded with the statement that "precedence is given partly in the order of filing and partly in recognition of the need of the claimant, in accord with the information available".

It is not stated whether all of these 400 claims "decided" have been adjudicated favorably and awards granted on them or whether they have simply been considered and only part of them allowed. Also, the concluding statement is apt to brew false hopes in the breasts of many deserving claimants, so the following facts should be set forth for their information.

The Relief Commission has summarily rejected all claims not having the endorsement of a personal or direct request by some employee of any of the five Government agencies named in the Relief Act and from whom emanated all requests and demands for the production of the war metals. The Commission bases its action in doing this solely upon its own interpretation of the opinion of the Attorney-General in construing the language of the Relief Act.

The language of the Act could not be more clearly couched in the English language when it states that all claimants that produced or prepared to produce any of the war metals "at the request or demand" of the five Government agencies named in the Act are eligible to compensation for their net loss so incurred. The form of these requests or demands, whether personal, published, or written, is immaterial, and it is a well-known fact that the restriction to confine relief under the Act to those that were "personally requested" was thrown out of the Act when it was in conference between committees from the Senate and House of Representatives. And despite the apparent desire to disqualify many of the small and unknown producers from their just benefits under the

Act, the Attorney-General in his opinion did not venture to re-instate such a restriction that had previously been deleted from the Act. But in what appears to be an attempt to befuddle pure English, he stated that the claimant must have been "asked specifically" by some one of the five agencies to produce the war metals in order to receive its benefits.

In view of the many specific requests formulated by different agencies of the Government during the War and issued through the public press, such as food regulations, Liberty Loan sales, the Draft, and innumerable other specific requests, any miner that read or was apprised through the public press of the Government's request for the production of the war metals, and who was qualified by a knowledge of mining methods to fulfill such request, emphatically and unquestionably was in receipt of a specific request, and was in consequence "asked specifically" to attempt to produce the war metals. The accompanying observation of the Attorney-General in his opinion, that no general appeal or solicitation to produce the war metals could be recognized as a basis for compensation for financial loss to the claimants, was utterly superfluous and irrelevant to the facts in the case, since there was not nor could be such a thing as a general appeal or solicitation for the production of the war metals. The requests for their production emanated from specific sources and was a specific request for a specific article. Yet, despite the fact that neither the language of the Relief Act nor the opinion of the Attorney-General holds that a claimant must have received a direct or personal request in order to come within the purview of the Act, the present Relief Commission has arbitrarily and illegally re-introduced that rejected restriction to relief into its administration of the Relief fund and is unlawfully and deliberately despoiling the great mass of small and deserving producers of the war metals.

Under this present reprehensible procedure, the small unknown miner that failed to scrape an acquaintance with some petty official of the five agencies named in the Relief Act, yet who took in good faith the published appeals and requests of the head officials of these same bureaus to produce the war metals and who patriotically expended his meagre funds in searching out and opening up a deposit of these metals in response to his Government's appeal, is to be despoiled, while the large corporation, which had an opportunity to get in touch with some official of the Mining Bureau, the Department of the Interior, or any of the other specified agencies responsible for the production of the war metals, now has a friend at court and is receiving the proper largess.

However unjust and outrageous this procedure, it is being followed without a scruple by the present Relief Commission and the three members of that Commission intend to adhere to their course until the end of the chapter, as is evidenced by the following excerpt from a letter which I recently received from a prominent senator in Washington, a member of the Senate Committee on Mines and Mining, and who is one of the very few that are making a fight for justice and a square deal to the rejected and despoiled war metal miners. He writes:

"I received this morning [Oct. 15th] a copy of a letter addressed to the Chairman of the [Senate Mines and Mining] Committee, in which it was stated that if the [War Minerals Relief] Commission were permitted to complete their work under the present law, there, no doubt, would be a substantial amount still remaining and unused in this [War Relief] fund. The letter further states that by that time the Commission will have a knowledge of the situation which will, perhaps, enable Congress to establish a more liberal rule of award than that now existing and under which many of the claims now ruled out can receive attention."

Comment on this astounding implied ignorance of the present situation on the part of the Commission had best be expressed in private; it wouldn't look well on the printed page. After completing a trip around the country of several months duration, during which hundreds of cases of the war-metal miners were heard, and thousands of dollars squandered from the Relief fund in endeavoring to ascertain the exact amount by weight or volume or value of the quantity of patriotism that induced these miners to enter into the production of the war metals, this Commission ponderously states that by the time all the favored claimants are paid—and the appropriation seriously depleted—it will have a "knowledge of the situation!" With all the conveniences at its command at that time; with the testimony of hundreds of claimants; with abundant evidences of actual want and physical financial distress unquestionably produced, the Commission signally failed to grasp or acquire that essential "knowledge of the situation" necessary to dispense impartial justice in accordance with the simple instructions of the Act.

The communication to the Chairman of the Senate Mines and Mining Committee blandly intimates that by the time the Commission has worked up to the requisite "knowledge of the situation", it will be in a position to advise Congress just what to do to make things right for the illegally rejected claimants. The insufferable impertinence of such an insinuation can only be grasped when it is known that these outraged and despoiled claimants, through their friends in Washington, for two months past, have had Senate Joint Resolution No. 81 before Congress and only await ratification of the Peace Treaty before asking action on it. The aim and intent of this measure is to assure just compensation under the Relief fund to those whom this Commission has unjustly attempted to exclude from its benefits.

It is plainly evident, however, that the Relief Commission wishes to go ahead with its hog-killing in its own way: Doesn't wish to be bothered by the interference of Congress in behalf of hundreds of miners that are to be ground-sluiced off the premises because they failed to obtain the official pass-word to the family potlach. It is opined, however, that after the great part of the appropriation has been ladled out to the elect, who have passed the bureaucratic muster, been declared orthodox and de-

serving of grace, the Commission will be in a position to give the ostracized insurgent claimants just oodles of "attention". And it may be well to expect little else, since the mantle of insincerity that has shrouded the entire war metals matter since its inception gives but slight assurance that dependence can be placed upon any official's word that a substantial amount of the fund will be left after the Commission's expenses and the favorite awards are deducted therefrom. The insurgents will be invited to have a drink after the pool has been dipped dry.

But it cannot be denied that it certainly is extremely considerate of the Commission to pose as the prospective guide, philosopher, and friend of the despoiled claimants, after the bulk of the Relief fund has been ladled out to claimants that have no more or as much right to reimbursement as they. Very generous indeed is this empty reparation; as yet only vague and unsubstantial as the repudiated promises that led these miners into the production of unprofitable war metals.

F. H. Mitchell.

Hot Springs, Arkansas, November 8.

State Insurance

The Editor:

Sir—The fairness of the California State Compensation Act as given in your editorial of November 15 makes it look as though little can be rightly thought in criticism of the law and its workings. But you have not written from all standpoints. The law is a travesty here and is considered a rankling sore. I will give you only a few incidents regarding its application that I know.

Mr. Eaton, in obtaining insurance for his men at the Fortuna, subscribed with the Aetna company at nearly 7% of payroll, considering therein that it would be preferable at that rate with the State Board or Bureau of Compensation. He claimed to have had very disagreeable experience with the Bureau regarding his garage men's insurance. His minimum premium was $200, even at 7%.

One of the factors closing down the Pennsylvania-Carlotta mine about a month ago was the demand of the inspector for the State Bureau causing offsets at every 30 ft. in their ladder-way to the bottom of their 400-ft. shaft. As the order came from the source of their money to fix the shaft to satisfy the inspector, the changes were made costing $1200. The insurance could be obtained only by first offsetting the ladder-line. I did not hear what they paid.

Last month I began inquiry for information regarding the insurance of my men with the State Bureau at our county-seat, Sonora, and could not get started into it here. Nobody knew where or how to do it here and nobody was a representative of the State Bureau. It seems that nobody can be paid a small per cent for so acting for the State Bureau as is done in Nevada. I was told that nobody in this county is known to have ensured with the State Bureau. All the insurance that I could hear of was done with the Aetna company by the largest mining outfits. I joined the flock. The charge for my policy was at a minimum of 5.85%, which had been reduced from 6% just recently. And I paid $59.70 as my minimum for three months. This is to be increased by such amount at the end of three months as the resultant of multiplying the total of my payroll for three months by 5.85% shall be found to exceed $59.70. Think of it! And the only satisfaction possible is to come from comparing with Mr. Eaton's paying $200 nearly two years ago. In a June number of the 'E. & M. J.', the Nevada rate is given as 2.85% of payroll. The Aetna agent said it was about that same rate here before the State began insurance.

How can a mining employer feel justly treated in having to put up $59.70 as against a farmer's minimum of $10? What is the use of talking about a dividend or return of 35% of my rate of 5.85% of payroll as against that previous rate of the Aetna company and the rate in Nevada, and both the latter paying commissions for business?

I overlooked to state that private companies are by duress (so the agent explains) compelled to charge the full rate to us that the State charges.

Geo. E. McClelland.

Sonora, California, November 17.

The 'Price' of Gold

The Editor:

Sir—Academic discussions as to the 'price' of gold and its relation to finance are interesting, but have not been of much practical help to the unfortunate gold miner. The cost of his gold continues to increase, while the price remains the same. It is stated that the value of gold used for commercial and manufacturing purposes in the United States this year will amount to $60,000,000, probably not much less than the country's total production of gold during 1919. In this case, the cost of the gold remains the same as before the War, while the price to the ultimate buyer of the finished article will, one may assume, be increased. It may not be possible to raise the price of gold when taken by the Government as a basis of money, but it seems unreasonable and inequitable that jewelers and manufacturers should be able to obtain their gold at the same price as formerly, irrespective of the greatly increased cost of production. The standard value of gold as money at present holds down its price as an article of use or luxury, in spite of enormous demand.

New York, November 7. W. D. Pagan.

Deposits of chromite have been known in Alaska for several years, but they became of economic interest only in 1917, when the high price of the ore made it possible to mine it commercially at one property. The chromite deposits of present interest in Alaska are at the south-west end of Kenai peninsula. A description of the deposit now mined and a map showing its location are given in a short paper by J. B. Mertie, Jr., published as part of Bulletin 692-D of the U. S. Geological Survey.

Short Cuts in Mine Surveying—II

By DOUGLAS WATERMAN

The Brunton Compass. For the sake of convenience and rapid work one should learn to use the Brunton without the aid of the tripod. As the needle is rather sensitive in these instruments, some practice will be necessary before the compass can be held with steadiness in the proper position; but the knack once acquired, bearings can be read quickly and within half a degree.

Hold the compass close to the body with the muscles of the hands and arms relaxed; any tension of the muscles will cause unsteadiness. The cover of the instrument holding the mirror is supported by the base of the thumbs, and moved backward or forward until the reflection of the object is visible, when the instrument is directed so that the image and the reflection of the forward sight coincide. Care should be taken to have the compass level in the direction at right angles to the line of sight, otherwise an accurate alignment cannot be obtained. The bubble-tube attached to the clinometer should be placed with its axis at right angles to the line of sight, and the bubble maintained in the centre of the tube while the sight is taken. If the instrument is inclined too much in the other direction, the needle will be thrown out of balance or strike against the cover-glass. A free movement of the needle is all that is required in this case.

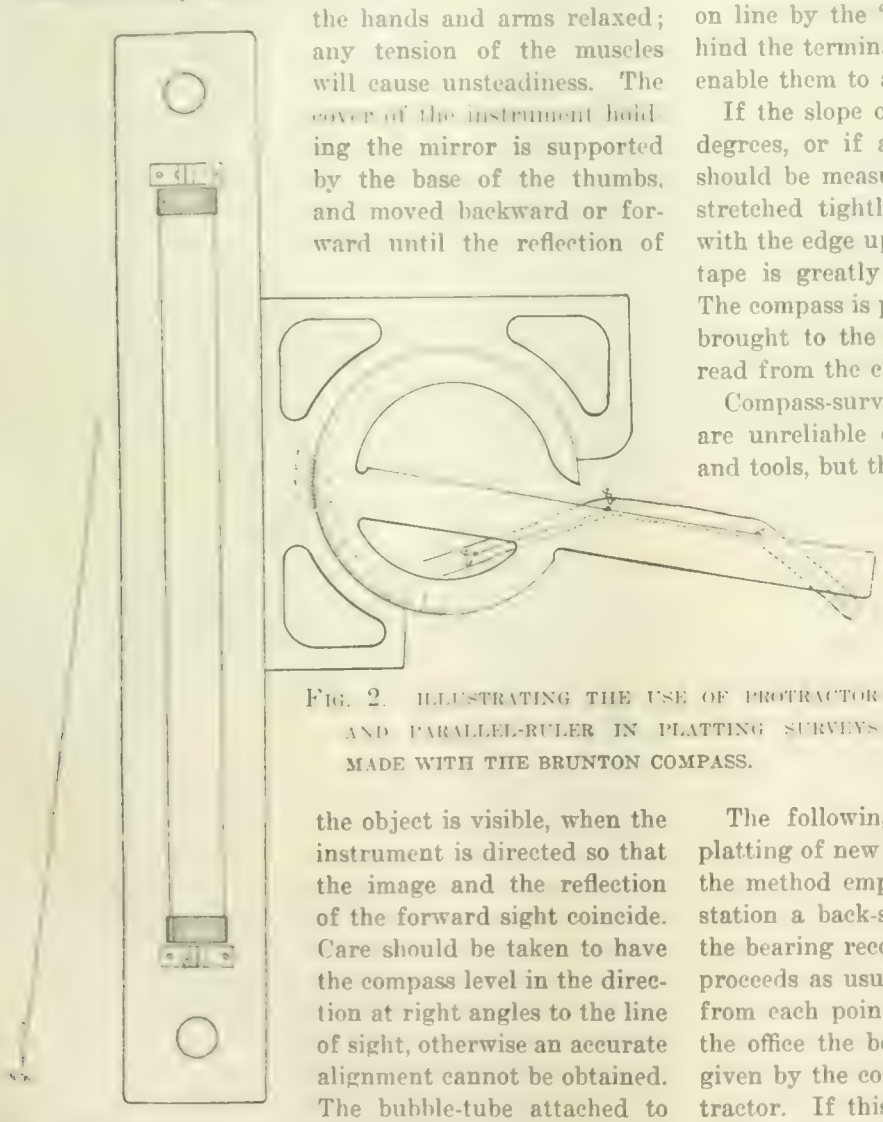


FIG. 2. ILLUSTRATING THE USE OF PROTRACTOR AND PARALLEL-RULER IN PLATTING SURVEYS MADE WITH THE BRUNTON COMPASS.

With two chain-men a traverse can be covered almost as fast as the men can walk; the time required in measuring the distance between points being sufficient to allow the instrument-man to determine and record the bearings. If the instrument-man is required to act as 'rear chain', more time is consumed, as new bearings must be taken at each advance of the tape unless the turning-point is some definite object on which a long sight may be taken. A twig stuck in the ground, or a stone placed on line by the 'head chain' will indicate to the one behind the termination of the last measurement. This will enable them to advance together, saving much time.

If the slope of the ground is more than two or three degrees, or if a profile is required, the vertical angle should be measured. This is done by holding the tape stretched tightly at an even height above the ground with the edge uppermost. In this position the sag of the tape is greatly lessened, especially close to the hand. The compass is placed on the edge of the tape, the bubble brought to the centre of the tube, and the inclination read from the clinometer arc.

Compass-surveys as usually conducted underground are unreliable owing to local attraction of rails, cars, and tools, but they may be carried out with absolute correctness within the degree of accuracy obtainable from the reading of such an instrument—from one-half to one degree. This is close enough for the purpose of indicating on the mine map the advance in development work, which is traced in pencil on the plan, to be finally inked in and colored after the transit survey is completed.

The following description of the measurement and platting of new development work will serve to illustrate the method employed. Standing at the nearest transit-station a back-sight is taken to the preceding one, and the bearing recorded in the note-book. The survey then proceeds as usual, but in addition, a back-sight is taken from each point in turn and the bearing recorded. In the office the bearing between the two transit-points as given by the compass is layed off on the arm of the protractor. If this bearing is tested with the true bearing as platted on the map, it will generally be found to vary several degrees, depending upon the amount of local attraction. If the arm of the protractor is made to coincide with the line connecting the two transit-points and a line traced along the base of the protractor, a new meridian is established, which will vary from the true meridian by the variation in the compass reading. In practice it is not necessary to draw the north and south

line if a parallel-ruler is at hand, as this may be used to give the direction of the new meridian by adjusting it against the base of the protractor. The fore-sight is now read from the notes and layed off on the protractor and the bearing traced on the plan, using the new meridian just found.

Fig. 2. is an illustration of the use of the parallel ruler and protractor in platting compass-surveys on the mine plan. A portion of a drift is here shown with two transit-stations, 303 and 305, and a compass point *a*. It is supposed that there was considerable local attraction at the point *a* requiring the employment of the method just described. The position of the parallel ruler with reference to the magnetic north shows the amount of local attraction at this point, but the bearing from *a* to the centre of the face of the drift if layed off from the position of the parallel-ruler will be the true bearing of the line.

To explain the method in a different and perhaps clearer way: if the back-sight at any point gives a bearing of due west and the fore-sight due north, then an angle of 90° has been turned, and it is this angle and not the magnetic bearing that is layed off on the plan.

Transit Surveying by Deflected Bearings. The method of deflected bearings, of course, has much to recommend it, compared with the customary practice of carrying the azimuth of the course, although it differs from it only in the manner of recording the deflected angle. By this method the true course is read directly from the instrument, requiring no calculations as in the case of azimuths. The bearing of each course is checked by the bearing of the needle, with which it must agree within reasonable limits. If a mistake has been made it can be discovered and rectified at once. The procedure is as follows:

With the instrument set up over the initial point and carefully leveled, bring the zero of the plate graduations to correspond with the zero of the vernier. Clamp the upper motion and turn the instrument until it points due south. The needle sometimes sticks, so it is well to tap the instrument lightly with the finger to be sure that it has come to rest in the true position. Clamp the lower motion and release the upper.

If the initial point happens to be a station in a previous traverse, the course of the back-sight is determined from the notes and layed off on the vernier, and the upper motion clamped. The back-sight is then taken, and the cross-wire brought to bear on the point by means of the tangent-screw of the lower motion. The object in first pointing the instrument due south is that there may be no mistake in fixing the angle in the proper quadrant, which might occur if the bearing was only a few degrees from one of the cardinal points of the compass. When the reference course is established as either that of a previous traverse or magnetic south, sight on the next point or station and read whichever one of the two verniers show an angle less than 90°, and record the bearing of the course. A glance at the needle will indicate in which quadrant the angle lies.

If one or more side shots are to be taken from any station it is convenient to leave the sight to the next turning-point until the last. The upper motion should be firmly clamped, and the alignment perfected by means of the tangent-screw. Record the rod-reading, bearing, vertical angle, and height of instrument. The instrument may now be moved to the next station; but before doing so it is well to loosen the lower motion in order that the instrument may swing more or less freely, thus avoiding the chance of a movement of the upper plate, which is often caused by the weight of the telescope when in a horizontal position.

Set the instrument over the next turning-point and sight back to the preceding one. Record the rod-reading, magnetic bearing, and vertical angle. Observe the bearing as shown on the plate to be sure that no movement has taken place while carrying and setting up the instrument. A complete check is thus obtained on the observations at each station; this will establish confidence in the accuracy of the survey as it proceeds, affording a valuable incentive to rapid and efficient work.

A comprehensive description of each sight taken should follow in the space provided for that purpose, in order that the notes may be interpreted easily by anyone who may have occasion to re-plat the survey. Sketches of roads, creeks, buildings, and general topographic features will greatly assist in filling in the notes.

Tie in the work by frequent sights on prominent landmarks, and join it to previous surveys wherever possible. Information thus gathered will assist in producing a finished map at some future date.

Unless assisted by a topographer, it is well in hilly country to run out several contour-lines more or less accurately. The rod-man may be directed in placing the rod at a fixed elevation, and a series of sights taken at marked changes in the direction of the contour. These lines established, it is an easy matter to plat the intermediate contours.

Stadia Measurements. For the purpose of stadia measurements, the telescope is provided with two additional horizontal cross-wires spaced at equal distances on either side of the central wire. On looking through the telescope at the graduated rod, it will be observed that a certain distance is intercepted by these cross-wires. If it is considered that the lines of sight from the intercepted points on the rod converge at the eye of the observer, then, from the proportionality of similar triangles, the intercept on the rod will vary directly as the distance of the rod from the apex of the triangles. When the ratio of the intercept to the distance is known (usually fixed at 1 : 100) a ready means is afforded for determining any distance within the range of sight. This is the basis of the method of measurement by stadia.

Owing to the combinations of lenses forming the telescope, this proportion cannot be used directly. The apex of the triangles from which distances are measured must be considered as being in front of the object glass at a distance equal to the focal length of the lens.

In order to obtain the distance of the rod from the

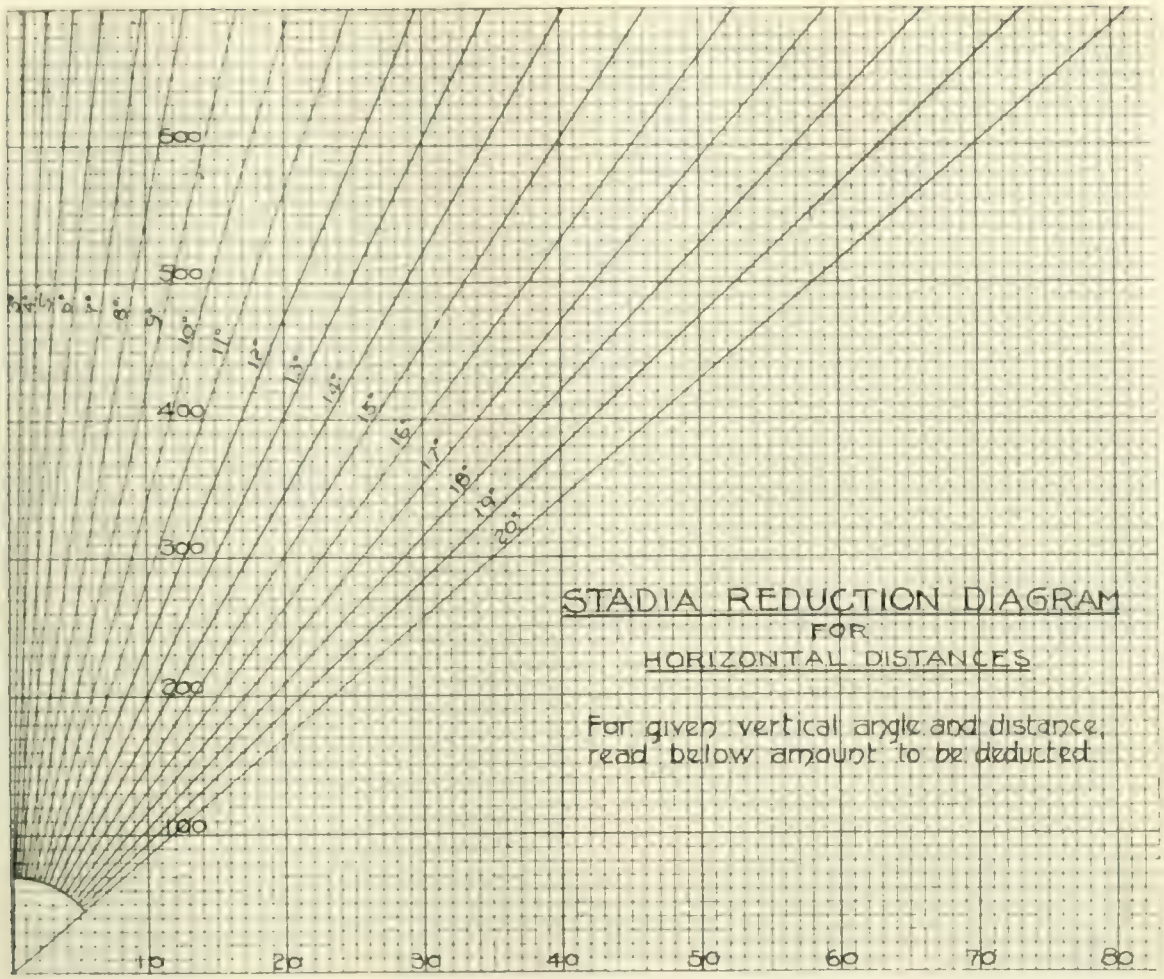


FIG. 3

centre of the instrument, both the focal length of the lens and the distance of the objective from the centre of the instrument must be added to the observed rod-reading. The focal length is constant; the distance of the objective from the centre of the instrument varies slightly as the telescope is adjusted to near or far sights, but, for all practical purposes, it may be considered a constant. The sum of these two distances is known as the 'constant of the instrument' and is designated by the letter *c*. It is usually one and a half times the focal length, which may be determined closely enough for the purpose by focusing the telescope on a distant object and then measuring the distance from the objective to the capstanheaded screws holding the cross-wires.

ILLUSTRATING THE OPTICS OF STADIA MEASUREMENTS

So far only horizontal sights have been considered. When inclined sights are taken and the rod held vertically, which is more easily done than at right angles to the line of sight, other elements are introduced requiring a further modification of the formula in order to obtain the horizontal distance and the difference in elevation.

In their reduced form these formulas are as follows:

$$D = \frac{f}{i} R \cos^2 \alpha + (f + c') \cos \alpha \; ; \; E = \frac{f}{i} R \frac{\sin 2\alpha}{2} - (f + c') \sin \alpha$$

D = horizontal distance.
E = difference in elevation.
c' = distance from the centre of the objective to the centre of the instrument.
f = focal length of the lens.
R = reading of the rod.
α = vertical angle.
$(f + c') = c$ = constant of the instrument.
$\frac{f}{i}$ = ratio of the intercept to the distance (generally 1:100 as being the most convenient).

As an aid to computing these results, tables have been compiled giving the values of $\frac{f}{i} R \cos^2 \alpha$ and $\frac{f}{i} R \frac{\sin 2\alpha}{2}$ for $R = 100$, and angles from 0° to 30°.

The second term that involves the constant of the instrument may be determined for the particular instrument and added to the result which has been obtained from the table.

Convenient reduction diagrams for horizontal distances are given in Fig. 3 and 4. By their use the computations are reduced from a multiplication of large numbers to a simple subtraction, which in many cases can be performed mentally.

The diagrams were constructed in the following manner: The difference between the unit distance of 100 ft. and its corresponding reduced horizontal distance was obtained by subtraction for each degree of vertical angle. As the difference varies directly as the distance, values corresponding to 700 ft., the extreme distance represented on the diagram, were obtained by multiplying by 7. These values were plotted on the diagrams and connected by straight lines passing through the origin. Then any point on the diagonals represents the difference between the distance as read on the rod, and the reduced horizontal distance for the indicated angle and distance. In these particular diagrams an instrument constant of 0.75, which is common in the lighter instruments, has been taken into account as well; this further simplifies the computations.

Examples in the use of the diagrams: Stadia reading 500 ft., and vertical angle of 10°. Follow down the vertical section-line nearest the intersection of the horizontal line representing 500 ft. with the 10° diagonal and read 14.4 ft.

500 − 14.4 = 485.6 ft., which is the reduced horizontal distance required.

By interpolating between the diagonal lines the diagram will serve for any angle, and an accuracy of within a few tenths may be obtained.

In surface surveying there are occasions when accurate measurements of distance and difference in elevation will be required, as, for instance, in laying out buildings, shafts, connections with underground workings, or a claim survey in localities where the possibility of lawsuits with owners of adjoining properties must be considered. Accurate measurements of this character will require the use of the steel tape with transit or level, but for general work the stadia method will prove satisfactory.

The equipment consists of a transit, one or more rods with rod-level for each, plumb-bob, reading-glass, and small hand-axe for cutting brush and driving stakes. For long traverses it is well to have two assistants, one to hold the rod for the back-sight and the other for the fore-sight. In topographic surveys where a number of sights are to be taken from each station, an experienced surveyor can utilize the services of a number of assistants.

It is understood, of course, that all inclined distances must be reduced to horizontal distances in order to be platted on the map. This requires a reading of the vertical angle in every case. By the method usually

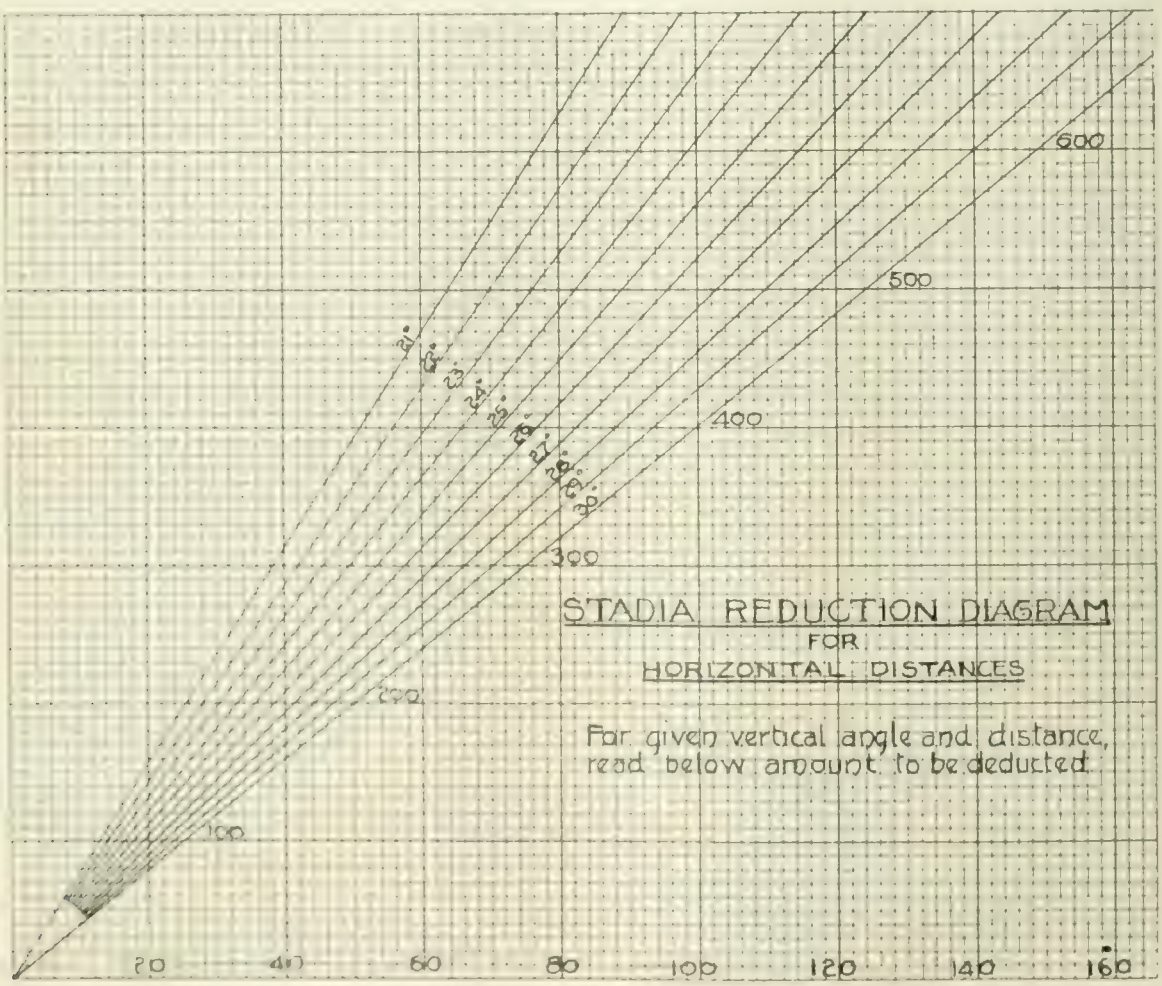


Fig. 4

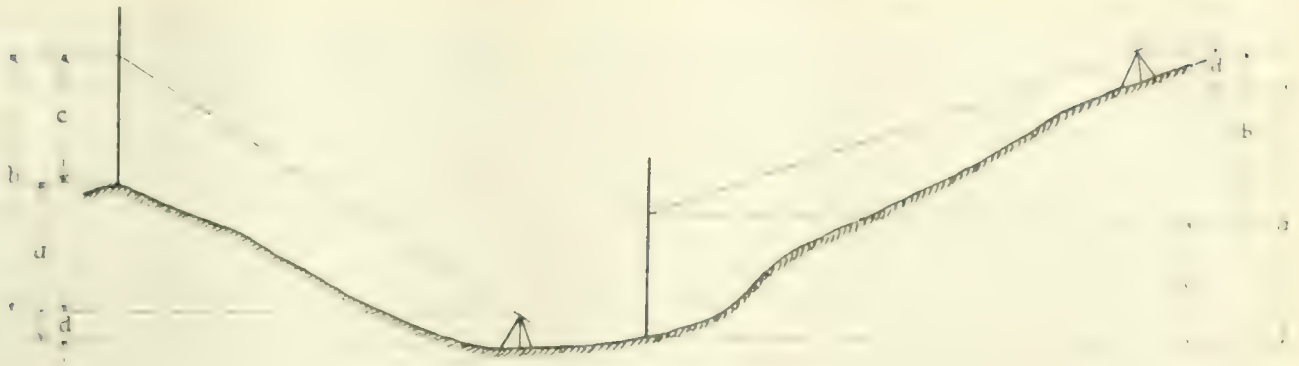


FIG. 5.—STADIA MEASUREMENTS.

taught, the line of sight is brought to instrument height on the rod before reading the angle. This is difficult or impossible at times, owing to intervening brush or immovable objects, which prevent a sight being taken on this part of the rod. By the following method both the horizontal distance and the difference in elevation may be determined if a reading can be taken on any part of the rod intercepted by the extreme or even the two upper cross-wires.

Reference to Fig. 5 will make it clear how this is accomplished.

a = difference in elevation required.

b = height of instrument above or below the intercept of the line of sight on the rod.

c = height of the intercept of the line of sight on the rod.

d = height of instrument.

Then for depressed angles $a = b + c - d$.

And for elevated angles $a = b - c + d$.

Record the readings of the upper and lower cross-wire; the vertical angle; and the height of instrument. The mean of the two stadia-readings will give the height c; the difference of the two readings will give the slope-distance, from which the height b is calculated, using the stadia-diagram or tables.

By following this method a reading of any part of the rod will serve to give the necessary data for making the reductions for distance and difference in elevation. Often an opening through the trees will allow of a sight being taken without any cutting of the brush. It frequently happens that the rod can be covered by only two of the wires. Where accuracy is not of prime importance, the reading may be taken and the slope-distance determined by doubling the observed intercept on the rod. This also applies to very long sights that are beyond the range of the rod for the two extreme stadia-wires.

As a subtraction is necessary in obtaining the slope-distance, it is convenient wherever possible to bring the lower cross-wire to cover an even footmark, thus simplifying the calculations and lessening the chance of error.

As previously stated, the reduction tables are calculated for a vertical position of the rod. If the rod is not plumb when the reading is taken, accurate results cannot be obtained. A circular or other form of rod-level will greatly assist in holding the rod in this position.

If not provided with such a level, the rod-man still has a means for holding the rod in the correct position. The rod is held by the thumb and fingers of both hands placed well above the centre of gravity and suspended over the point. It will then assume a vertical position which, with care, can be maintained after the rod is lowered to rest on the stake or ground.

While the rod is self-reading for distances varying from 300 to 600 ft., depending upon the power of the telescope, the eyesight of the instrument-man, and the light on the rod, it is often desirable to take longer sights. This can be done with accuracy by using a second target, which, for convenience, should be made so that it can be slipped on and off without sliding in the groove, but capable of being clamped tightly in place. By using both targets, one for each cross-wire, distances of 1000 to 1200 ft. may be determined. The auxiliary target is set at the direction of the transit-man, who either takes the reading when he arrives at the station, or has the assistant call it out to him.

MINE SURVEYING. (1). Setting Permanent Points. Before beginning any serious survey work in or about a mine, two permanent points should be established on the surface, to which present and future lines on the surface and underground can be referred.

Intelligence is required in choosing the position of these points. Although it is desirable to locate one of the points within easy chaining distance of the main entrance to the mine, it should be placed out of the way of future shaft-buildings, timber-yards, or tram-lines.

If the vein is inclined, it is advisable to place the points on the foot-wall side, as the ground over the vein is almost sure to settle after the upper portion is stoped out.

The second point should be placed at some distance from the first—say, 400 or 500 ft.—so that the line joining them may serve as a base-line for triangulation surveys of the property, and in such a position that an unobstructed view may be obtained between the two points.

An excellent 'point' consists of an inch rod firmly set in a low monument of concrete or masonry. The rod may be punch-marked on the top for the accurate centring of the instrument.

Almost the first work of the surveyor would be to determine accurately the horizontal distance and difference in elevation between the two points; also the true bearing

and magnetic bearing. The elevation of the points should be established. This may be an assumed elevation or one referred to a known bench-mark.

Development work underground having reached the stage where a more accurate survey than can be carried with the Brunton is desirable, permanent points are established on the main working levels. These are tied in with permanent surface points by means of suspended wires if the shaft is vertical, or with the top telescope if the shaft is inclined and too steep for sighting with the main telescope.

The permanent points or stations if fixed in the roof of the drift are least liable to be disturbed. Holes are drilled in solid ground, into which tapered wooden plugs are inserted and driven tightly in place. Ordinary staples, such as are used to fasten wire-netting, are driven into the plugs, leaving enough exposed to accommodate the plumb-line. A tag of sheet-zinc on which the number of the station is stamped, is tacked by the side of the staple, two or more nail-holes having been punched for this purpose.

If stoping has been done above the level, or the ground is too soft or fractured to hold a plug, the point will have to be fixed in the floor of the drift. Usually it can be fixed in a sill or tie. A tack or small brad is driven home and surrounded by staples or a ring of tacks to make its position more easily identifiable, and marked with a numbered tag, as in the case of the plug.

In numbering the stations, it is well to follow some system, in order to avoid confusion. If the mine has required the services of an engineer a system will undoubtedly have been established, which it is well to follow unless there is some good reason for making a change. Almost any system will serve if adhered to consistently, but the following is mentioned as having some advantages.

In many mines levels are driven approximately 100 ft. apart, either vertically or on the slope of the vein, in which case it is customary to speak of the levels as the 100-level, 200-level, etc. In all but very extensive workings the number of required transit-stations will not exceed 100. Therefore if the stations are numbered for example 110, and 455, they are immediately identified as being on the first and fourth levels. If the workings lead in both directions from the shaft, by placing all the even numbers on one side, and the odd on the other, the stations will be still further identified, and can be more readily found on the plan of the workings.

It is convenient to have a set of tags for each level prepared in advance of the work. By utilizing one of the nail-holes, the tags can be strung on a wire in numerical order, from which they may be slipped off as required; thus avoiding danger of duplication, which might occur if the tags were numbered only when needed.

In surveying underground a fixed routine should be followed. The helper then knows the sequence of each step in the survey, and no directions on the part of the surveyor are necessary. This is of especial advantage when the survey is carried on in the proximity of active work, where the noise of machine-drills would effectually drown the voice if verbal directions were attempted. The following routine is recommended as one that economizes the time devoted to the survey.

If the station-point happens to be in the floor of the drift, the transit is set up and adjusted by means of the tripod-legs so that the plumb-bob is brought as nearly as possible over the point, the accurate centring of the instrument being accomplished by loosening the leveling-screws and shifting the instrument on the foot-plate.

If the point is in the roof the instrument is placed so that the punch-mark on the top of the telescope is directly below the suspended plumb-bob, care being taken to have the instrument level, with the level-bubble in the centre of the tube, otherwise the punch-mark will not be in line with the vertical axis of the instrument.

To illuminate the plumb-line the helper holds a piece of tracing-cloth between it and the candle. Against this translucent background the cross-wires are sharply defined, so that a rapid and accurate alignment may be obtained. In drafty places it is sometimes a convenience to be provided with a bottomless cracker-tin over which a piece of tracing-cloth is stretched and fastened. Held inside this contrivance, the candle will be protected from air-currents.

With the vernier at zero a back-sight is taken to the last station-point of the preceding survey, and the lower motion clamped. The helper then comes forward and takes the end of the tape, which he carries to the next station. After attaching the plumb-bob and bringing it to rest, he holds the light for the fore-sight. The upper motion is released and the instrument revolved about its vertical axis, the fore-sight taken, and the horizontal angle recorded in the notes, with the letters *R* or *L* to indicate in which direction the angle has been turned. Some engineers prefer to turn the angles always to the right, so that there can never be any chance for a mistake. The bearing of the needle is also recorded as a check on future calculations. The distance between the plumb-line and the horizontal axis of the instrument is measured with the tape, which is stretched tightly at instrument-height, and the reading taken and recorded to hundredths of a foot.

While the assistant is returning to illuminate the plumb-line for the second back-sight, the engineer measures with a pocket-tape the height of the instrument, in this case the distance of the axis of the instrument below the station-point, indicated by a minus sign in the notes. The 'roof to floor' distance is also measured, as this is needed in carrying the elevations of the floor of the drift, and in drawing cross-sections of the workings.

The instrument is turned, using the lower motion, and the back-sight is taken again. The assistant removes the plumb-bob and again comes forward, this time carrying the reel with him, the engineer retaining the end, and the tape is left stretched along the floor of the drift in line with the forward sight, the most convenient position for measuring the offsets. The forward sight is taken and the double angle recorded. When the engineer has as-

sured himself that the telescope is level, he directs the assistant in sticking a pelet of candle-grease on the plumb-line on a level with the middle cross-wire, thus providing a mark from which to measure 'height of point'.

The engineer now measures the offsets 'Left' and 'Right' with the pocket-tape, using the 100-ft. tape as a base-line, and also as a means of ascertaining the distance along the drift of each measurement. His assistant meanwhile returns for the instrument, which he brings forward for the next set-up. The measurement of the 'height of point' completes the cycle of operations.

(To be Continued)

The Mineral Wealth of Persia

The natural resources of Persia are almost inestimable, and up to the present the great wealth of this ancient country has scarcely been touched. The now famous Anglo-Persian oil-fields are a vivid example of what can be done when the necessary enterprise and capital are forthcoming. The large area over which this company possesses the rights of working contains an almost inexhaustible supply of oil. There is at least one other oil-field in Persia waiting to be exploited. A few Baku experts have known for some time of the existence of oil in the north-eastern part of the country. This district is judged to be exceedingly rich in oil-bearing strata and is situated close to the south-eastern shore of the Caspian Sea.

Beyond any doubt the plateau of Persia is extremely rich in mineral wealth, but the question has been how to work it, owing to the difficulty of transport. In the past reliance has had to be placed on mules and camels, whose loads can not possibly exceed 400 or 500 pounds. This being so, the importation of the necessary heavy machinery has been out of the question, and as a result the greater part of Persia's rich mineral wealth lies dormant.

Seventy miles or so to the north of Isfahan is a disused gold mine that was originally worked by the Persians themselves. The ore was extracted in a crude and antiquated way and then carried to Teheran on the backs of mules, a distance of over 200 miles. There the gold was extracted by some old-fashioned process, and as the profits only covered the expenses the mine was ultimately closed down. With modern methods and up-to-date machinery on the spot such a venture should prove a paying concern.

Gold-dust is found in various parts of Persia, principally in the river beds, but not in any great quantity, with perhaps one exception. It is regularly brought into the Kermanshah bazaar for sale, but from exactly where has so far been kept a secret. Lead and silver are both to be found in payable quantities. Lead is at present being profitably worked by the Persians themselves. The mine is situated in the mountains not far from the Gavkhaneh lake, while some years ago there was a flourishing silver mine in the south-eastern part of Persia which had to be closed down owing to the hostile attitude of the local tribesmen.

In considering the mineral wealth of the country, copper undoubtedly takes the most important place. Persia is full of copper, but so far it has not attracted foreign capital, because of the import and export difficulties that have had to be contended with in the past. In spite of these many drawbacks, at least one mine is being worked locally. This is situated not far from the Isfahan Yazd road. Reliance has to be placed on charcoal for smelting purposes, but the output of copper is sufficient to justify the mine being worked. A little to the north of Isfahan, in the Natanz mountains, is a large vein of copper. The Kerman district abounds in copper, and in the judgment of a mining engineer who has visited the neighborhood any operations seriously undertaken would easily repay the necessary capital that would need to be invested.

Should financiers be ready to embark on such a venture as the exploitation of Persian mines, the question of both coal and transport would have to be seriously considered. Fortunately coal exists in many parts of the country and is at present being mined in at least two places. Tabriz is supplied with coal from a neighboring mine, and Teheran coal has to a large extent taken the place of wood as fuel. Coal in this latter city is undoubtedly expensive, as the mine from which it is obtained is situated some distance from the city. Besides, the method of extraction is unsatisfactory. A hole is dug in the ground and the coal when reached is thrown to the surface, but when this is no longer practicable the excavation is abandoned and a fresh one started. Naturally the best coal is never reached. Coal is also to be found in close proximity to many of the rich mineral areas. It is known to exist in the Natanz mountains; to the south, west, and east of Isfahan it lies exposed on the surface. The district of Kumisheh is especially rich in this mineral, and quite recently it has been discovered in the Curdish mountains bordering on the Baghdad-Hamadan road.

THE ALASKAN MINING INDUSTRY in 1918 has just been set forth in detail in a report by the U. S. Geological Survey. Regular mining may be said to have begun in Alaska in 1880, when the Juneau gold placers were first exploited. It is estimated that since that time mineral wealth has been produced to the value of more than $418,000,000. The mineral production of the Territory in 1918 was valued at only $28,253,961. This output was almost $12,500,000 less than that for 1917 and was the smallest since 1914. The decrease was chiefly in copper, the production of which fell from 88,783,400 lb., valued at $24,240,598, in 1917 to 69,224,951 lb., valued at $17,098,563, in 1918. The reduction in the output of copper was due to shortage of labor and ships. The production of gold decreased from 709,050 oz., valued at $14,657,353, in 1917 to 458,641 oz., valued at $9,480,953, in 1918, and was the smallest since 1904. The reduction in the output of gold was due chiefly to curtailment of operations.

Fig. 2

Fig. 4

The Haulage of Heavy Machinery

By H. L. GOODWIN

The accompanying photographs are submitted to illustrate the application of two principles that are of great importance in hauling heavy loads. First, the motive power should be applied as close to the load as possible, and second, the vehicle should have tires of sufficient width to support the load without cutting deeply into the road.

Where horses are used, as is generally the case, the bad effect of having them strung out at some distance from the load lies mainly in the necessity of taking up the slack in the rigging. This is not so important a factor where trained teams, used to working together day by day, are used, but with the scrub teams often of necessity employed in hauling heavy mining machinery it is of considerable moment. The difficulty lies mainly in getting the horses to pull steadily as a unit. When the rigging is so made up that the total tractive effort is applied to the load at several places, say, two or three, this trouble is largely eliminated.

Fig. 1 shows how ten horses and a motor-truck were used in hauling a heavy grinding-mill. Two horses were left on the pole, and the other eight were placed four abreast in the lead. Each of the four-horse units was attached directly to the load by chains from the middle of a long spreader. It was also necessary to attach the ends of the spreaders to the load, so that if the off horses should pull more than the near, for instance, no harm would result. The motor-truck was used with a push-pole in the rear.

Fig. 2 indicates the use of ten horses, six in front of the load, two abreast, and four in the rear, hitched to a push-pole. This is much preferable to having the ten horses strung out, two abreast, in front of the load.

The width of tires on the vehicle is evidently of minor importance on paved thoroughfares, but on earth roads a great burden is added if the wheels sink into the road. Tires should be at least six inches wide for loads of over five tons. Fig. 3 shows how two sets of 5-in. tired wheels were used with essentially the same effect as though wider-tired trucks had been available. The two pairs of wheels used at each end of the load were placed close together, and so connected with chains that they would 'follow' correctly in going around curves.

Another use of the motor-truck in this work is illustrated in Fig. 4, when it became necessary to resort to tackle in order to get a heavy crusher up a steep grade. Two horses were left on the pole to steer the load, and the truck was trigged in position to serve as an anchor for one end of the tackle. The advantage of having an anchor so readily movable is evident.

Flotation Oils

The following is taken from a business letter:

"Sometime ago I sent you sample pine tar oil. Am sending you by parcel post sample crude wood turpentine. Have one barrel turpentine and 80 gallons pine tar and quote you a flat price of 30c. per gallon on the entire amount. Of the many businesses that have been associated with in 40 years, flotation oil is the limit. You have a good customer and some charcoal burner from Louisiana or Florida will convince him that he has a better product and you have to wait until he uses the car before you can sell him again or some relative of some stockholder has a relative who is in flotation or you have a nice business and have a strike and your business is gone, and am through and am making you a price to clean up."

FIG. 1. SEE OPPOSITE PAGE

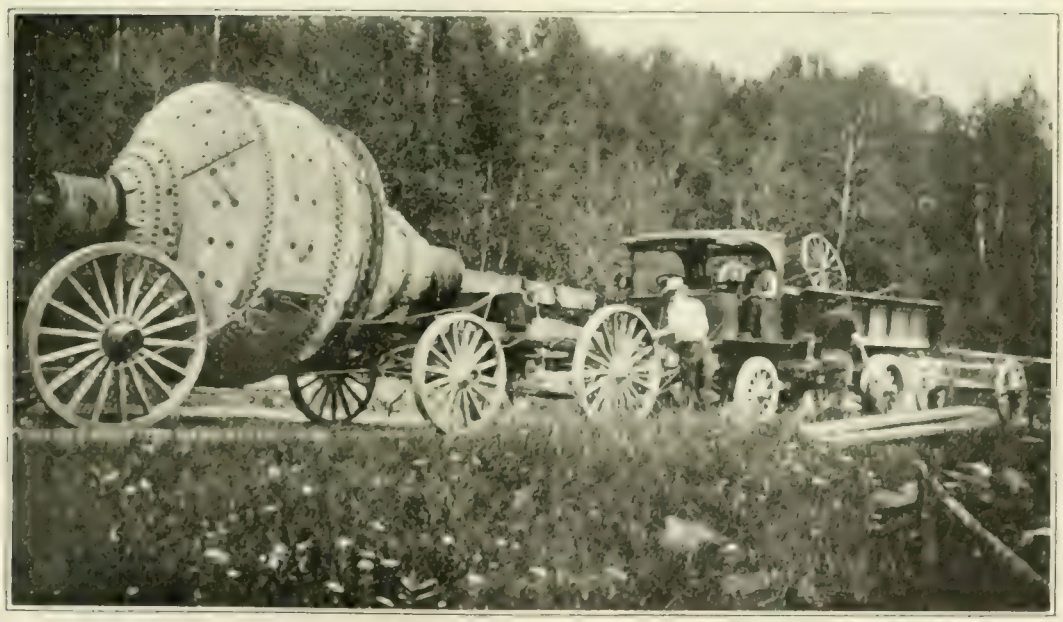


FIG. 3. SEE OPPOSITE PAGE

The Duty of the Mining Industry

By GEORGE OTIS SMITH

*The realization of America's large heritage in the form of natural resources prompts us to regard ourselves as divinely elected to world-leadership. And indeed no people can more truly or more profitably repeat for their own benefit the words of Milton:

> "Accuse not Nature! She hath done her part;
> Do thou but thine."

The rank of the United States in the world's mineral industry is shown by the fact that in the last normal year, 1915, our output of the principal mineral commodities constituted about 36% of the world's production, or as much as the six leading nations of Europe together. Here is where figures are more eloquent than adjectives in expressing America's industrial leadership. Yet such endowment of national wealth brings its responsibilities, and the obligation laid upon our industry is measured in a way by the very abundance of the treasure in this greatest storehouse of mineral fuels and ores of the useful metals.

Platitudes about our duty to the Nation do not meet the present need. The test of the individual or the industry is the contribution made to the general welfare. We correctly describe our industry as a producer of basic wealth, but in the policy of the mining industry the dominating note should be not 'wealth' but 'welfare'. In promoting the general well-being our industry is called upon to play no small part. I am going to suggest that we consider the nature of our contribution to the Nation; our particular problems in industrial partnership, the duty of our industry to other business, and the relation between the mining industry and the Government.

During the war period, in addressing a group of my farmer friends in Maine, I told them that the world doesn't owe the farmer a living, but, on the contrary, the farmer owes the world a living. I believe that proposition continues to express the truth under peace conditions, and I would now add my economic and social conviction that the other great productive industry which we men represent here also owes the world a living. Our duty is to provide an adequate supply of the raw materials from which can be fashioned the almost infinite variety of manufactured commodities that the modern world requires. The part, then, of our industry in the cosmic scheme of things is to furnish the world with fuel, with metals, and with all the other mineral raw materials which civilization takes as a matter of course but without which civilization cannot survive.

The exact measure of our contribution to the world, however, is not the dollar. Some of us with a statistical bent love to note the fact that the value of our country's annual mineral production passed the billion-dollar mark in 1899, reached the two-billion mark in 1907, exceeded three billion dollars in 1916, and attained five billions in 1917, and five and a half billions last year. Yet the total value of our annual output is a starting-point for economic self-examination rather than a goal reached that justifies self-glorification. The dollar is a handy measuring stick, but the results it gives need to be verified; quantity and quality of commodities give the truer measure of their usefulness. As a newspaper editor recently put it: "We don't eat dollar-marks; we consume production."

The reported value at the mine-mouth of our coal output may be significant of wages and possible profits to the mine-workers and mine-owners, but it does not measure the heat-units made available for the world's work and comfort. So, if we look behind the camouflage of increased prices, we see that the jump of nearly a billion and a half dollars in 1917 did not mean that our mines contributed an additional 42% to the world's needs. As a matter of fact, of such essential metals as copper, iron, and lead, as well as gold and silver, there was a decreased output, a loss to the world, aggregating more than half a million tons. Again, last year the half-billion dollar increase in market-value expressed not an increase but a decrease in tonnage of such leading items as iron, lead, zinc, gold, and silver. In short, the number of loaded freight-cars that daily leave your plant gives a good measure of your usefulness to the world, irrespective of the size of your daily bank-deposit.

The most gratifying part of the record of American mining and metallurgy is found in the increasing annual output of coal or iron per miner, the steady improvement in recovery of metals from refractory ores, the continued lowering in the grade of copper ore that can be handled at a profit, and the increased safety to life and health of the workers. All this is the result of engineering in the service of man, and in a material way all this tends to increase the tonnage of your output, without increase in price and probably even with lowered costs. So it is that, rather than take the grand totals for our coal and oil and metal expressed in dollars as the true index of our prosperity, we can better claim credit for our industry when prices are low and yet our mines are running full time and our furnaces full blast.

The fact of partnership in industry is now generally recognized and we need discuss only the ways and means for putting into effect this principle of community of interest. Prosperity in any business cannot be one-sided, the public, labor, and capital—all three—must share its

*An address delivered by the Director of the U. S. Geological Survey before the Mining Congress, at St. Louis, on November 18.

benefits. So, too, an idle industry assesses its losses upon each of these three partners. The coal industry furnishes abundant illustration of this truth; the curve of weekly coal production tells the story of highly irregular operation, and idle plants and idle men are expensive taxes upon the community and the Nation.

The advantages of regular employment accrue alike to labor and capital; it is the year's earnings that really count, whether it is the dollar or the man whose service we thus measure. Now, if we study the country's soft-coal business as a whole, we find a gratifying improvement during the war period in the average number of days of employment—from 195 days in 1914 to the top record of 249 days last year. But these averages for the country unfortunately include low figures for certain States, and usually for the same States year after year, a relation that deserves this comment: wherever the working year is shortest, there dissatisfaction with the conditions of labor is keenest; in other words, where the coal mines have not enough market to keep them running a long working year, there we find labor unrest. For example, the average working days per year for Ohio, Indiana, and Illinois for the last five years have been 176, 196, and 206, respectively, as contrasted with average of 252 days for Alabama, 258 for Virginia, and 292 for New Mexico.

Of course the above relationship is not simple; cause and effect are mixed in this coincidence of short years, labor unrest, and Union strength, and it must be noted that mine-owners as well as mine-workers suffer from every interruption to the full opportunity for earning that comes only with continuous operation. The underlying cause of bad conditions in the coal industry is the seasonal fluctuation in demand, which has resulted in the country being over equipped with coal mines and coal miners. The three States mentioned as favored with longer working years owe this advantage to a market, largely metallurgical and railroad, to the demands of which the mines are fairly well adjusted.

For three months this last spring the coal mines of the country were operated, on an average, for only about 24 hours per week. From coast to coast the reason for lost time was 'no market', something beyond the control of either operator or mine-worker. Here, then, is the greatest branch of our mining industry vitally affected by a widespread malady, the remedy for which lies with the public alone. Arbitration-dictation-legislation cannot cure such deep-seated trouble. Laws cannot make coal mines operate when there is no outlet for their product, but education of the consuming public may accomplish much in bettering the conditions of demand, and we as consumers will do well to remember that the price we pay for coal must in the long run be enough to pay for the idle days of both mines and miners as well as for the days they work. The public interest lies in a longer working year, not in a shorter day or week. Largely on account of the irregular market demand for coal, our mines since the armistice have actually averaged only 30 hours working-time per week; throughout the year there have been too many mines and too many miners waiting for work. A 30-hour week is the ailment—not the cure.

Reference to this fact of industrial partnership is not complete without mention of the third partner, the public. Whether we belong to the mine-worker or to the mine-owner division of the mining industry, our duty is the same; we must promote the general welfare. A recent editorial in the 'Saturday Evening Post' pointed out that the doctors and the nurses have the right kind of class consciousness; they are conscious that their duty to the whole people takes precedence over their selfish interests.

A true diagnosis of the financial condition of our industry involves book-keeping that states the real economic symptoms. In mining as in all other productive business, production costs should express all the facts, but I am convinced that we have not yet reached that stage in our accounting methods. The annual reports of our largest mining corporations and the studies by the Federal Trade Commission alike fail to tell the whole story in their statement of production costs, which are made to include the wages of labor but not the wages of capital employed. The Federal Trade Commission in its definition of cost specifically excludes interest on investment, but can we do that in the world of realities? Does not the cost of a pound of copper just as truly include its share of the interest due on the bonds and the dividend due on the capital stock actually paid in—that is, wages paid to capital—as it includes the wages paid to the mine-worker or the man in the smelter? Of course, neither payroll should be padded. Do not regard the definition of profit as simply an academic question for college professors to discuss: it is more a matter of fundamental concern to the men who are trying to build up the industry.

In the first place, such terms as 'net earnings', 'profit', 'net income', 'surplus', or 'balance to surplus account', which appear on your financial sheets, are too optimistic in tone when the operating costs do not include any charge on account of the investment. The inference is too easily drawn that this surplus is available for profit-sharing between labor and capital. For example, the Federal Trade Commission report on copper is quoted in newspaper headlines as showing "28% profit in copper", yet in this report the wage to labor is set forth as the first and largest item among the elements of cost, this item alone averaging 5⅛ cents per pound in 1918, but cost of capital is not included. The report, however, shows that the 85 copper companies discussed would require an average of 3 cents per pound to pay 10% on their actual investment, yet this 3 cents does not appear in the 16 cents of average cost, but instead it forms a part of the 8 cents of so-called 'net profit', which the unwary may regard as the actual difference between price and cost.

In the second place, I fear lest accounting that does not count all the costs may lead us to fail to appreciate the results of American engineering. Our mining engineers, backed up by red-blooded capitalists, are constantly lowering labor costs by increasing the investment

in improved mine equipment. This means replacing the hardest part of labor with machinery working dollars instead of men, so that your cost-keeping conceals the true state of things, if you pay labor out of so-called 'costs' and capital out of so-called 'profits'. By your improvement in equipment you are subtracting from one side of the account and adding to the other, thus ever making the margin apparently larger than it really is. The great strides in advancing our mining industry have come through large investments in plant, and we must in fairness include a living wage for capital as well as for labor when we figure the cost of winning this or that metal from the low-grade ores, metal that a few years ago not all the labor in the world could have won for the use of mankind.

I have elsewhere suggested that industry must have a conscience, irrespective of the old charge that corporations have no souls. Our mining industry cannot stand right in the eyes of the modern world unless it plays fair with the rest of the business organization. We must try to see the other side of the shield, whatever the transaction with our fellow-men, and I can best illustrate the application of the Golden Rule in economics by citing our relation to the railroads.

As the railroad's largest customer, the mining industry is largely concerned in the solution of the transportation problem now so prominently before the American public. It is plain that adequate service and low rates mean much to the health if not to the very life of our industry, yet even as large buyers of transportation we should not seek preferential rates at the expense of the rest of the public, any more than as sellers of fuel and metal we should be willing to let the Railroad Administration procure its supplies from our mines and furnaces and mills at prices so related to bare cost that the public must make up the difference. You coal-operators know too well how that style of shoe pinches to wish the same kind of narrow policy on the reorganized railroad system. We must allow freight-rates to be determined by facts of transportation cost, rather than by what we claim to be the exigencies of our own business. Even a legislature cannot impose rates, however they may seem calculated to serve public interest, that would deny to the railroad the reasonable reward necessary for its financial and physical upkeep. The Supreme Court has ruled that a State law cannot force a railroad to haul coal at a loss on the supposition that the profits in the wheat traffic will recoup the carrier. So it is that in a spirit of fairness the mining industry ought to help in the adjustment of rates on a basis adequate to revive healthy conditions on our railroads.

Some reference to the relation between the mining industry and the Government may well follow my remarks on business conscience. Standing as I do a little closer to the Government side I prefer to emphasize the duty of the Government to the industry. I believe in a strong government, strong enough to regulate and even control in the public interest every industry, but above all I believe in a just government. Back in Washington we have a body of public servants whose desire is to serve the whole people, but most of us are human, and newly acquired power may sometimes affect our vision, so that we make the wrong moves. In its relation to the mining industry the Government needs to be fair, whether the relation is that of mineral landlord or of business investigator or of tax-collector or of purchaser of fuel and metals. Disregard of established equities, ill-advised charges of bad faith, threats of commandeering, or offers of confiscatory terms are no longer warranted in these days when the Government's necessities are no greater than those of other consumers. Indeed, the principle laid down by President Wilson during the War that the Government rate should be the same as the rate to the public should have been followed by every one down the line, whatever his title or insignia of office. Now that we have had time to regain our poise, I think the public servant generally wishes to serve rather than to commandeer.

We in the Government service, however, must realize the necessity of being even more scrupulous in our exercise of power than if we were in private business. I like to keep in mind the words of Judge Severns in the Federal Circuit Court of Appeals:

"It derogates from the dignity and character of the Government to suppose that, formed as it is to secure impartial justice between individuals, it may nevertheless in the conduct of its own affairs, without regard to the principles it represents, perpetrate upon its citizens wrongs which it would promptly condemn if practised by one of them upon another."

In my opening words I suggested that welfare rather than wealth be the dominating note of our industry. But wealth may be defined as provision for future welfare, inasmuch as it is the surplus beyond present needs. To the present-day problem of industrial unrest, then, what is the answer, except to create a larger surplus? As I analyze the economic situation, surplus of production over consumption can come through decreased consumption or increased production or both, but it cannot come through restricted production or increased consumption or both, and the shortened day of labor surely means both less produced and more consumed. Whether among individuals or among nations the old-fashioned ideas of industry and thrift come nearer the natural law than the new proposition of a five-day week and a six-hour day. No protective tariff can safeguard the home market for industries based on a 30-hour week, nor can our industries expect to win or hold a place in foreign markets on any part-time program, unless there is some international agreement making for universal indolence, and even then we may discover that there can be no return to Garden of Eden conditions of consumption without productive industry. I believe the earliest precedent was a continuing injunction for a six-hour day, and no lower court has since ordered any better rule of action or reversed that divine injunction.

NICKEL ORE from North Carolina has been concentrated magnetically from 0.97% to 3.6% nickel.

Bill to Facilitate Deep Exploration for Copper Deposits

Mr. Carl Hayden, Congressman from Arizona, has introduced a bill, H. R. 10433, to provide for the disposal of certain lands in Arizona, New Mexico, Nevada, and Utah containing deep deposits of copper ore. The legislation proposed by the Hayden bill is designed to meet and deal with a condition to which the existing Federal mining laws are not applicable.

The important copper deposits in the States mentioned do not occur in technical 'vein' or 'lode' formation, but in extensive low-grade bodies, usually underlying a heavy overburden of wash, conglomerate, or non-mineral-bearing formation. To discover such underlying deposits, deep and expensive drilling or shaft-sinking is necessary, requiring months, and even years, for its accomplishment. Under the existing law a discovery in such a drill-hole or shaft could serve to validate, and vest possessory title to, only one claim, 1500 by 600 ft., or an area of only about 20 acres, which is insufficient to justify the great outlay involved.

In the past the mining communities have attempted to meet the conditions by locating claims and doing annual assessment work in the overburden. Such claims, in most instances unsupported by any semblance of discovery, have been recognized as property and bought and sold as such, but, generally speaking, the ground has remained undeveloped.

In many instances meagre surface showings, not connected with the underlying deposits, have been claimed as discoveries and even made the basis of patent proceedings. In the early days the Land Department did not examine critically into the matter of discovery unless the question was raised by protest or contest, and large numbers of such claims were patented. This was the case at Bisbee, where the ore-formation occurs at a depth of 1000 ft. or more. In later years the Department has established the practice of requiring a detailed showing as to the character and quality of discovery claimed and of making, through its field-service, an investigation on the ground. As a result, the Department has been confronted with the question as to whether inconsequential mineral showings in the overburden could be accepted as sufficient to constitute discovery, as in the case of the Rough Rider and other claims that were finally patented because it was felt that the previous patenting of similar claims in the vicinity had established a rule of property.

But, generally speaking, lands of the character contemplated by the proposed legislation cannot now be patented unless discoveries are made by deep drilling or shaft-sinking. On the other hand, large areas of such land were in the early days patented under the non-mineral laws, under the rule that land could not be classified as mineral in character, or patented as a mining claim, unless mineral had been actually disclosed. In recent years, however, the Department has adopted the rule that, through geological deduction as to underlying deposits, land may be classified as known mineral in character, and now declines to patent such lands under the non-mineral laws.

There are thus large areas of land in the four States mentioned which the Land Department recognizes as being mineral in character, but which remain undeveloped because title thereto cannot be acquired under the present mining law.

To justify the expense of exploration by drilling or sinking shafts to a great depth, as well as the large outlay in working-shafts, machinery, and equipment for actual mining operations, it is necessary that a reasonably large acreage be acquired or controlled. To operate on the scale required, not only are extensive orebodies requisite, but a large area of surface is also needed for reduction plants, tailing-dumps, etc. The proposed legislation is designed to encourage the exploration and development of such lands by giving to any one who will undertake deep exploration the right to control and acquire an area of not to exceed 1280 acres (which is about the minimum area now held by any of the large porphyry-copper mining companies) upon conditions carefully designed to prevent abuse of the privilege.

The text of the bill follows:

"*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled.* That the Secretary of the Interior is hereby authorized and directed, under such rules and regulations as he may prescribe, to issue to citizens of the United States, or to any association of such persons, or to any corporation organized under the laws of the United States or any State or Territory thereof, prospecting permits which shall give the exclusive right for a period of three years to prospect for deposits of copper in rock in place underlying an overburden of wash, conglomerate, or non-mineral-bearing formation, in tracts of land in the States of Arizona, New Mexico, Nevada, or Utah, belonging to the United States, containing one thousand two hundred and eighty acres or less, upon condition that the person, association, or corporation receiving any such permit shall begin operations within one year from the date of the permit and shall within two years from and after the date of the permit drill one or more test holes, or sink one or more test shafts, to a depth of not less than five hundred feet, unless a deposit of copper be sooner discovered, and shall within three years from and after the date of the permit drill a test hole or holes or sink a test shaft or shafts to an aggregate depth of not less than fifteen hundred feet, unless a deposit of copper be sooner discovered. And if it appear that the permittee shall have complied with the foregoing requirements but failed to discover any deposit of copper, upon application therefor such permit shall be extended for a further period of

three years upon condition that the permittee shall during each year of such extension drill or sink five hundred feet, unless a deposit of copper be sooner discovered; and the Secretary of the Interior may, if he shall find that the permittee has been unable, with the exercise of diligence, to test the land in the time granted by the permit or such extension thereof, extend any such permit for such further time and upon such conditions as he shall prescribe with a view to the exploration of the land embraced in the permit: *Provided,* That a tunnel or drift of length equal to the depth required for a drill hole or test shaft as hereinbefore provided shall be regarded as the equivalent of any such drill hole or test shaft so required.

"SEC. 2. That whether the land sought in any application be surveyed or unsurveyed the applicant shall prior to filing his application for permit locate such land in a reasonably compact form and according to the legal subdivisions of the public-land surveys, if the land be surveyed, or in an approximately square or rectangular form if the land be an unsurveyed tract, the length of which shall not exceed two and one-half times its width. If the applicant shall cause to be erected upon the land for which a permit is sought a monument not less than four feet high at some conspicuous place thereon and shall place a notice in writing on or near such monument, stating that an application for permit will be made within thirty days after date of said notice, the name of the applicant, the date of the notice, and such general description of the land to be covered by such permit by reference to courses and distance from such monument, and such other natural objects and permanent monuments as will reasonably identify the land, stating the amount thereof in acres, he shall during the period of thirty days following such marking and posting be entitled to a preference right over others to a permit for the land so identified: *Provided,* That where lands of the character hereinbefore mentioned have been located and held as mining claims and annual assessment work done thereon as required by law, the locator or holder thereof, or the locator or holder of the prior location thereof in case of conflicting locations, shall have the preference right to a prospecting permit hereunder. The applicant shall within ninety days after receiving the permit mark each of the corners of the tract described in the permit upon the ground with substantial monuments, so that the boundaries can be readily traced on the ground, and shall post in a conspicuous place upon the land a notice that such permit has been granted and a description of the land covered thereby and cause such a permit to be recorded in the office of the recorder of the county in which the lands described in said permit are situated.

"SEC. 3. That upon the discovery of a valuable deposit of copper within the limits of the land embraced in any permit and proof of the expenditure in labor and improvements thereon of not less than a sum equal to $25 for each acre thereof, and upon the payment to the proper officer of $5 per acre, the permittee shall be entitled to a patent to such tract of land, to be described by the legal subdivisions of the public-land survey, if surveyed, or, if unsurveyed, to be surveyed by the Government at the expense of the permittee in accordance with the rules and regulations to be prescribed by the Secretary of the Interior, and the lands patented shall be conformed to and taken in accordance with the legal subdivisions of such survey, and deposits made to cover the expense of surveys shall be deemed appropriated for that purpose, and any excess deposits may be repaid to the person or persons making such deposits or their legal representatives.

"SEC. 4. That this Act shall not apply to any lands in any military or Indian reservation, national park, or national monument, or lands in any coal, oil, gas, or phosphate reserve or withdrawal."

Mineral Explorations in Alaska

Many of the Aleutian Islands, that crescentic line of volcanic isles and islets that stretches westward from Alaska Peninsula toward Asia, bear deposits of sulphur of the type called solfataras. Sulphur claims have been located at three places on these islands and on the peninsula, one of them in the crater of Makushin Volcano, on Unalaska Island. This peak, which is about 6000 ft. high, is capped by perennial snow and ice and bears glaciers on its slopes down to points about 2500 ft. above the sea. The sulphur deposit is the only part of the crater that is permanently free from snow and ice, being kept so by subterranean heat and by the discharge of hot sulphurous vapor, which issues from vents in the rocks with a loud roar. In this crater 10,000 to 15,000 tons of sulphur may be available for mining. Another deposit of sulphur is on Akun Island. It covers 15 to 20 acres and contains about 1200 tons to the acre. Still another is on Stepovak Bay, on the south shore of Alaska Peninsula.

A. G. Maddren, who examined these deposits for the U. S. Geological Survey, examined also the deposits of placer gold in the beach sands on Kodiak Island, where mining has been carried on for 30 years, and where the value of the annual output of gold has ranged from $3000 to $10,000. He sketches the geology of the island and describes the beach deposits that contain the gold and their mode of origin, as well as the methods used in mining. Here the sea has done for the gold miner the work that is done inland by streams—it has assorted and concentrated particles of gold, which were derived from the bluffs that border the beach for miles along the island. The storm surf along this coast is powerful enough to move boulders that weigh tons, and the play of the waves concentrates the fine gold in patches that yield good returns to the miner.

Mr. Maddren's reports can be obtained free of charge on application to the Director of the U. S. Geological Survey at Washington, D. C.

THE MINES of Fergus county, Montana, have produced more than $18,000,000 worth of metals, mostly gold. Gold was first discovered at Yogo in 1870.

FROM OUR OWN CORRESPONDENTS IN THE FIELD

ARIZONA

COPPER STOCKS ACCUMULATING—REPORT OF THE SALE OF THE COPPER BELLE MINES.

DOUGLAS.—Announcement was made at the offices of the Phelps Dodge Corporation in this city that on or about January 1, 1920, the department heads of the corporation who have been making their headquarters at Bisbee would remove to Douglas. This is a step in the corporation's policy of concentration and retrenchment. The officials included are Ellinwood and Ross in charge of the corporation's legal department, Gerald Sherman, consulting engineer, and McHenry Mosier, consulting geologist. Walter Douglas, president of the Phelps Dodge Corporation, and Arthur James, vice-president, arrived at Douglas November 22 after completing a tour of the properties under their control in the South-West. The next two days were spent in inspecting the Moctezuma Copper Co. holdings at Nacozari. Copper men generally feel pessimistic about the immediate future of the industry, as even at the present rate of curtailment the copper stocks of the various companies are increasing rapidly. Little or no copper is being sold and huge sums are being tied up each month in copper bullion without hope of sales in the immediate future. The failure of the peace treaty to be passed by the Senate caused bitter disappointment in mining circles of the South-West, as the copper companies are barred from making sales to the Central Powers. At the same time the rate of exchange prevents large transactions with either England or France. As far as can be learned there is no immediate intention of further curtailment either in production or force, but all the companies are 'cutting every corner'. Despite the fact that the only sales made recently have been at 18 and 19 cents, wages continue on the basis of 24 cents.

GLEESON.—A definite report, as yet unconfirmed, is that the Copper Belle mines, owned by the Shannon Copper Co., have been sold to the Calumet & Arizona Mining Co. for $450,000. For the last month engineers have been on the property preparing a report for the C. & A. In a recent interview in Boston, N. L. Amster, president of the Shannon company, was quoted as considering that the Gleeson mine had great possibilities, but that it might be sold. At that time the deal with C. & A. is believed to have been on. It is understood that the Shannon company will operate its Yeager property. Gordon R. Campbell and Captain Thomas Hoatson are inspecting the properties of the C. & A.

CALIFORNIA

NEWS FROM THE MOTHER LODE.

SUTTER CREEK.—The Old Eureka Mining Co. let a contract on November 11 for sinking its shaft 550 ft. below the 3000-ft. level, at a price of $29 per foot, contractors to furnish all explosives. This work will sink the shaft to a depth equal to the lowest level of the Central Eureka mine adjoining. Prospecting continues on the 2100-ft. and 3000-ft. levels. Thirty stamps have been dropping at the Central Eureka mine on ore averaging about $20 per ton during the past two months. The breaking of the 5-ton crown-wheel on the hoist necessitated a few days stoppage of mine work during November, but sufficient ore was in the mill-bins to keep the mill in operation until hoisting could be resumed, and it is expected the November production will equal that of October, which was a banner month. This mine has been operated on assessments for a number of years, but there now seems reason to expect a continuance of the present profitable work. The orebodies on the 3500-ft. and 3700-ft. levels are supplying most of the ore, and it is expected prospect work now under way on the 3300-ft. level will develop the same ore-shoot encountered two months ago on the 3500-ft. level. If so, a large amount of high-grade ore seems assured, for no mining worthy of mention has been done between these levels. Albion S. Howe has been managing the Central Eureka mine during the past year and a half.

JACKSON.—Scarcity of labor slightly handicapped mining operations at the Kennedy mine until recently, but at present 60 stamps of the company's 100-stamp mill are in operation on ore of good grade. Webb Smith is manager. At the Argonaut mine, although the Muldoon shaft remains sealed on account of the fire, operations are being vigorously continued, and the 60-stamp mill is running to capacity on ore from the lowest levels. The workings connecting the Argonaut with the Muldoon mine are effectively sealed, and miners are said to experience no difficulty in working on the Argonaut side.

AMADOR CITY.—As a result of the Keystone Mining Co. having no adequate means of storing its mill tailing, mining operations at that property are practically at a standstill. No ore is being hoisted and only a few men are employed on development work. The company formerly stored its tailing in the same basin as did the Original Amador mine, but the necessity has now arisen for raising the concrete dam if more tailing is to be stored there. This expense seems too great to meet un-

ore of better grade than that now in sight can be developed.

PLYMOUTH.—The Plymouth Mining Co has just completed its 2700-ft. station, and cross-cuts will now be extended to pick up the good ore developed on the 2600-ft. level. The shaft has been repaired and sections strengthened by reinforced concrete supports.

MICHIGAN

STATEMENT OF A GERMAN MANUFACTURER REGARDING COPPER PURCHASES.—OUTPUT OF MINES FOR OCTOBER.

HOUGHTON.—Seneca has not yet started to resume sinking on the first Gratiot shaft, recently purchased from the Calumet & Hecla. Securing equipment for the resumption of operations on this property is slow work. Unwatering will commence soon.

A Houghton army captain, while serving in Coblenz, made the acquaintance of a German manufacturer, from whom he recently received a letter which sheds some light on the copper metal situation. Translated freely the letter reads: "You will be interested to know that I have just completed arrangements for financing the shipments of copper which I need to get my business back on a normal basis again. It was arranged through my New York connections. I believe the War did small manufacturers like us a good turn. We have plenty of men again and many women willing to work full time at reasonable pay. So there is no trouble about labor. I went over the copper situation carefully before buying. There is no copper in Germany anywhere. The old time German copper trust that operated at Hamburg and Frankfurt is wiped out. It never could live without the Imperial Government back of it anyway. It controlled the product of Bohemia and all the imports from America. Now we buy direct from America. The German business-man has only to arrange to finance his affairs. I think I got in ahead of my competitors. I bought my copper at 21c., and that is Michigan copper too."

The Quincy company is erecting its new hoisting plant at No. 2 shaft. The contract for this enormous hoist was let in May 1917. It now is being set up, practically all the parts having been delivered from the Milwaukee shops of the Nordberg plant. The plant will have the world's record for one continuous hoist.

Hancock now has 10 machines at work. Two cross-cuts are being driven, one at the 44th and one at the 49th level, and the other drills are working in drifts on the east branches of the Pewabic lode. The management hopes to be able to open the formation on a larger scale so that it may take advantage of a change for the better in the metal market.

The production figures for the copper mines of Lake Superior for the month of October show substantial increases in the Calumet & Hecla group of mines, but falling off or just about even figures for the other mines. The most sensational increase in output was made in the Calumet & Hecla mine itself, which increased its ore output to 212,543 tons in October as compared with 180,017 tons in September, and increased its refined output of copper by 800,119 lb. Ahmeek, one of the Calumet group of subsidiaries, made an increase of 291,155 lb. of copper, an increase in ore tonnage from 61,720 to 68,000 tons, and a pronounced betterment in the quality of the ore, which increased more than 2 lb. per ton to 24.56 lb. Another mine of the Calumet & Hecla management that is coming rapidly to the front and making good the predictions of its friends is the Isle Royale, for a long time looked upon as a weak sister of this group, and always considered a low-grade property whose only hope rested in large output. In October this mine mined copper which ran 19.18 lb. per ton. White Pine entered the ranks of producers.

Mine	Ore tonnage	Lb. per ton		Refined	
		Oct	Sept	Oct.	Sept
Ahmeek	68,000	24.56	22.3	1,670,142	1,378,987
Allouez	17,000	19.86	24	337,628	362,562
Baltic	20,509	34	35	697,000	875,000
Calumet & Hecla	212,543	25	25	5,313,583	4,504,464
Centennial	6,750	16.9	16.8	114,500	95,050
Champion	41,000	40	40	1,640,000	1,700,000
Isle Royale	68,000	19.18	18.5	1,304,036	1,287,228
Mass Con.	13,242	15	15	198,632	200,000
Michigan	4,928	30	28.9	147,840	159,478
Mohawk	43,643	24.34	22.16	1,062,279	979,339
Osceola Con.	58,000	16.14	15.7	936,252	849,100
Quincy	96,000	18	18	1,728,000	1,700,000
Trimountain	14,000	25	26	350,000	364,000
Superior	95	17	17	.....	14,000
Victoria	7,650	14.4	12.8	110,160	140,000
Wolverine	24,022	16.62	14.55	399,249	386,899
Winona	6,333	15	12	95,000	93,000
White Pine	.....	..	..	28,000	.....
La Salle	No ore shipped			13,600	.....

MISSOURI

REVIEW OF THE JOPLIN DISTRICT FOR THE MONTH OF OCTOBER.

The month of October closed with shipments approximating 35,346 tons of zinc blende, with a valuation of $1,568,473. Calamine shipments approximated 1374 tons with a valuation of $39,507. The tonnage averaged 8836 tons weekly for shipments of zinc blende and 343 tons for calamine, or a total of slightly in excess of 9000 tons. This is a remarkable showing, due to the fact that the month opened with a severe shortage of cars and with small hope held out for any relief in the situation. However, by using broken-down cars that had been repaired by the shippers themselves, supplemented by empty coal-cars going through the district to the east, and by using trucks and teams for hauling lead, thus releasing cars for shipping zinc, a serious situation was bridged over. While no surplus stocks have been moved, and there is no hope of moving them for weeks to come, the shipments have taken care of the immediate necessities of the field and have made it possible to keep men employed who would otherwise have been out of work.

There has been very little advance in the price paid for zinc ores, the price ranging from $42.50 to $47.50 for zinc blende and from $25 to $30 for calamine. The average price paid for zinc blende for the month was $44.37, and for calamine $28.75. The month opened with a surplus stock of 30,000 tons and closed with 29,000, this being the unsold stocks in the bins of the ore producers. The ore buyers have purchased stocks in the field amounting to approximately 35,000 tons.

Shipments of lead ore have been good throughout the

month, aggregating 5685 tons and averaging 1421 tons weekly. Prices have been good, ranging from $75 to $85, the latter week seeing the price jump to $85. Cars for shipping have not been available, but local smelters have hauled the ore by trucks and teams to their plants so far as it was possible to do so, and have been able to keep their plants going and relieve the condition at the mines. By this method the surplus stocks have been wiped out of the district, and assistance given to the handling of zinc ores. The average price paid for lead ore was $79.65.

Labor conditions have been growing better and today there is an ample supply of labor in the district. However, producing conditions are anything but favorable, due to the coal strike which threatens to cut off all available supply of fuel for steam-plants, and will in a very short time cut off the electric power, as the major portion of it is generated by steam-plants.

The feature of the district's development for the past month is centred in the discovery of a new district for zinc and lead mining. This is south of Joplin, approximately six miles, where a wildcat drill-hole searching for water discovered an entirely new ore horizon below the 300-ft. level, which showed a 60-ft. face of zinc ore reported to have assayed over 20% zinc. This discovery has caused great excitement, and a general rush to grab the leases in that part of the country has taken place. The discovery was made upon the land of A. L. Carpenter, of Joplin. The American Zinc, Lead & Smelting Co. immediately secured a lease upon this tract as well as upon a considerable acreage of the surrounding lands, and is about to start a thorough campaign of drilling to test out the ground. The new tract is not a great distance from what was known as the 'Oleson mining camp' south of Spring City, where a good deal of shallow mining was done several years ago at an average depth of 60 to 70 ft. At present there is extensive lead mining at the shallow levels and some zinc silicate mining. The discovery is close to or along what is called the Seneca Fault, the only known structural deformation of any noteworthy extent in the Joplin district. This fault strikes south-west from Sturgeon, Missouri, running through Racine, Seneca, and on down into the State of Oklahoma. There have been a number of prospects along this fault, but all of them have been of shallow extent and of mediocre richness. The new discovery at a considerable depth for this field is therefore taken to mean that there are possibilities of mining along this entire stretch of broken structure, and mining operators in the district are securing leases and there will probably ensue a large prospecting campaign on the Missouri side of the line.

A GLIMPSE OF THE GREEN HORN MOUNTAIN MINE, SHASTA COUNTY, CALIFORNIA

NEVADA

GENERAL NEWS OF THE STATE.

ARROWHEAD.—The east drift on the 100-ft. level of the Arrowhead is 45 ft. long and the face is in ore 4 ft. wide and assaying rom $150 to $200 per ton. The winze from this drift is 30 ft. deep, with 4 ft. of ruby silver ore assaying $450 exposed in the bottom. The east drift on the 175-ft., or bottom level, is 120 ft. long and indications are that it is close to the ore-shoot, which rakes in this direction. The west drift on this level is 75 ft. long and it continues to cut seams of good ore of erratic width and value. The ore taken from the east drift on the 100-ft. level and the winze from this level is being saved for shipment to Tonopah, 60 miles distant. A gasoline-driven hoist is in use, replacing the whim formerly used. Other companies preparing to start work are the Arrowhead Bonanza, Arrowhead Extension, Arrowhead Consolidated, Arrowhead Signal, Arrowhead Syndicate, and Arrowhead Annex. The silver in the district occurs principally in sulphide form, with some chloride. The ore is found associated with calcite and quartz in well-defined veins with andesite and dacite-pohphyry walls.

GOLD MOUNTAIN.—The Washington Gold Quartz company, owner of the Randolph group, after prospecting the surface of the claims along the contact, is driving a drift tunnel to prospect the vein. The tunnel is 70 ft. long and, according to J. K. Turner, general manager for the company, it is nearing the intersection of the first cross vein. At 70 ft. the full face assayed $13. The ore

contains gold, silver, and lead. Preparations are being made to add a second shift of miners.

West Divide.—The south drift from the 60 ft. shaft of the West Divide has been driven 30 ft. in ore from 1 to 1½ ft. wide and assaying from $20 to $200. The shoot is irregular in size and grade. Shipments will be started from the north drift if satisfactory rates can be secured for transporting the ore from the shaft, to which a road cannot be built economically, to a road recently constructed to within several hundred feet of the shaft. A cross-cut has been started from the face of an old tunnel to cut the vein at a depth of 150 feet.

Goldfield.—Four lessees have shipped from the Florence in the past 10 days 360 tons of ore assaying from $35 to over $100 per ton, according to estimates. The Boesch lease in the old Riley block produced 200 tons, the first output from this lease in a long period. Shipments from the Florence Divide lease are irregular. The Florence company employs 12 men, 7 of whom are miners engaged in development work. Twenty-eight men are leasing or are employed by lessees. A vein 4 ft. wide and assaying as high as $16.40 per ton for this width has been opened in a cross-cut from the main south drift on the 500-ft. level of the Red Hill. The cross-cut was driven west into the foot-wall of the Rogers vein and drifts have been driven short distances in the newly discovered ore-channel which parallels the Rogers. Samples taken in the north drift at this point assay from $8 to $20.80, and in the south drift up to $7.40. Following agitation by the miners and craftsmen for a new wage-scale, the Goldfield Mine Operators' Association, inactive for several years, recently was re-organized. At a meeting at which practically all the companies were represented the wage-scale and living conditions were discussed with the result that it was decided to bring the influence of the Association to bear on the merchants in an effort to reduce costs. A committee was appointed and held a preliminary discussion of the matter with the merchants. There is no standard scale in the Goldfield district, the wage for miners varying from $5 to $6, some of the companies using a bonus system. Wages and living costs are of vital importance at this time in view of the plans of the Development company to treat low-grade ore at a small margin of profit.

Cactus.—Samuel Eichen, a New York real estate dealer, and Joseph Fynney and Albert H. Cutter, Boston bankers, are at the head of a syndicate that has financed the Cactus Nevada Silver Mines Co. for $280,000. Cactus is 24 miles east of Goldfield. The Cactus Nevada company was formed by Joseph F. Nenzel, interested in mines at Rochester, Nevada, and in other parts of the State, to take over seven claims owned by E. M. Bailey of Goldfield. The sale was made last May for a price reported to have been $30,000 cash. Bailey had developed the claims periodically for 15 years, the principal work being two 100-ft. and one 150-ft. shaft. The Cactus Nevada continued one of the 100-ft. shafts to 160 ft., which made it the deepest shaft in the district, and did considerable lateral work. The average width of the vein at 160 ft. is 25 ft. and the ore is reported to assay $25 for this width, containing from 90 to 95 parts silver to 1 of gold. The veins are in fissures and the walls are rhyolite and andesite. Three well-defined ore-channels extend through the claims, the principal one for a distance of 3000 ft. Mr. Nenzel, now in New York, is expected to visit Cactus in a short time to start work on a large scale.

UTAH

OPERATIONS OF UTAH COPPER FOR THE THIRD QUARTER.—NEWS FROM ALTA, EUREKA, AND PARK CITY.

Salt Lake City.—The Utah Copper Co. has released its 46th quarterly report, covering the third quarter of the current year. The production of copper from concentrate was 24,774,761 lb. and from leaching plant precipitates 494,918 lb., making the total output 25,269,769 lb., as compared with 28,046,978 lb. for the second quarter. The Arthur plant treated 1,397,400 dry tons, averaging 1.16% copper, with an average recovery of 76.20%, as compared with 1,242,500 tons for the second quarter, averaging 1.35%, with an indicated extraction of 81.8%. The decrease in output for the third quarter was due to the lower copper content of the ore. The average cost per pound of net copper for the quarter, excluding Federal taxes and without credit for gold and silver content or miscellaneous earnings, was 14.885c., as compared with 11.59c. for the previous quarter. The higher cost is due to the smaller production, and also to the increase in wages, effective July 16. The total net profit for the quarter was $2,419,512. On September 30 a dividend of $1.50 per share was paid, or a total of $2,436,735, resulting in a deficit for the quarter of $17,223, as compared with a profit of $215,369 for the second quarter. The earnings for the third quarter are computed at 22.225c. per pound, as against 14.74c. for the previous quarter. The increase in carrying price was due to sales of metal being in excess of production, whereas during the second quarter sales were much less than the output. There was removed from the mine 549,166 cu. yd. of stripping, as against 333,048 cu. yd. for the second quarter. The Bingham & Garfield railway transported an average of 8237 tons of ore per diem and 1712 tons of commercial freight. Since the beginning of dividend disbursements on September 30, 1908, the Utah Copper Co. has paid its stockholders a grand total of $99,325,988.

Alta.—Contractors at the Alta Tunnel & Transportation Co.'s property have driven the east drift in the direction of the Prince of Wales workings more than 70 ft. since the beginning of their 200-ft. contract. In doing this work a large amount of milling-ore has been taken out and many small bunches of high-grade uncovered. The drift is still following the hanging wall, and F. V. Bodfish, manager, is confident that it will soon pick up one of the ore-shoots, or chimneys, mined near the surface in the early days by the Prince of Wales Co., and is highly pleased with the rapid progress in the drift.

Connection should be made during December between

the 600-ft. level drift in the Cardiff mine and the Columbus Rexall tunnel, which will give the Cardiff mine an outlet into Little Cottonwood canyon for the shipping of its ore, according to Ezra Thompson, general manager for the Cardiff company. Mr. Thompson states that less than 250 ft. of driving is yet to be done before the connection is made. The work is being expedited by driving on both faces; the crew on the Cardiff side has less than 75 ft. to run and the crew on the Rexall side about 140 ft. before the two drifts well meet. The connection will be of immediate benefit because of the ventilation it will afford the Cardiff, but the adit will not be used as an ore-shipping outlet until next season, as the tunnel will have to be enlarged and considerable preparatory work done in it before it will be in such condition that ore shipments can be trammed through it.

EUREKA.—Ore shipments from the mines of the Tintic district took a leap upward during the week ending November 15, a total of 140 cars being shipped, as compared with 118 for the previous week. The Chief Consolidated, Dragon, Tintic Standard, and Iron Blossom mines almost doubled their output during the second week of November. Of the 140 cars, Chief Consolidated loaded 38; Dragon, 19; Tintic Standard, 18; Iron Blossom, 17; Grand Central, 10; Centennial-Eureka, 9; Eagle & Blue Bell, 6; Colorado, 4; Swansea, 3; Mammoth, 3; Ridge & Valley, 2; Bullion-Beck, 1; Victoria, 1; Eureka-Hill, 1; Laclede, 1; and Sunbeam, 1.

PARK CITY.—Shipments of ore from this district for the week ending November 15 totalled 1616 tons, of which the Ontario Silver furnished 530 tons; the Judge Mining & Smelting 487 tons; the Silver King Coalition 440 tons; and the Daly West 159 tons.

For the past two weeks men have been cleaning out drifts and other workings in the American Flag mine, and during the present week the boilers were fired up. This mine was a large producer in bygone days, and with the present high prices of silver and lead it is expected that it will again be among the leading producers of the district.

Photo by Tune: Goldfield

THE DEVELOPMENT MILL AND THE SLIME POND, GOLDFIELD, NEVADA

BRITISH COLUMBIA

COMMITTEE TO INVESTIGATE TAXATION OF GOLD MINES. ACTIVITY IN THE BARKERVILLE DISTRICT.

VANCOUVER.—With the depreciation in the purchasing power of gold the system of taxing the gold mines of the Province has become obsolete and unfair in the judgment of some members of the British Columbia Chamber of Mines. If the gold mining industry is to be maintained, they hold, the fundamental principle in fixing taxes must be the ability of the properties assessed to pay. Owing to the fact that, since taxes last were adjusted, mining costs have practically doubled, a joint committee, representing the B. C. Chamber of Mines, the Canadian Mining Institute, and the mine owners, has been appointed to investigate the matter and submit a report with a view to making whatever representations are thought advisable to the Provincial government before the next session of the Legislature.

BARKERVILLE.—The district of which the historic town of Barkerville is the centre, well-known to all old-time Cariboo prospectors, is becoming active again in preparation for renewed work next spring. The activity is attributed to the quartz claims situated on Prosperpine mountain, four miles north of the town, having been acquired by the Mining Corporation of Canada; this corporation, which has its headquarters at Toronto, has already commenced carrying out plans for the development of the claims. Under the direction of Robert H. Bryce, late of Cobalt and Porcupine, a crew of more than fifty men is now at work. Cabins have been built providing sleeping and eating accommodations for 100 men, together with offices and other necessary buildings. John Bell, an old timer in the district, has taken a contract for the driving of two tunnels of 200 ft. each, and I. E. Moore has a contract for a third and a fourth to be constructed. Two diamond-drills are being shipped to the property and soon will start drilling.

KAMLOOPS.—The difficulty of obtaining labor is hampering the completion of a number of enterprises which

are expected to benefit the mining industry. One of these is the branch line of the Canadian National Railways between Kamloops and Kelowna by way of Grande Prairie and Vernon. Another is the branch railroad from the Kettle Valley railway to Copper mountain, where the Canada Copper Co. is opening, on a large scale, extensive deposits of low-grade copper. A third is the construction by the Kootenay Power & Light Co. of its power line from Bonnington Falls, where the power is developed, to Princeton, where it is to be used by the Canada Copper Co. in its new mill. The new Kamloops-Kelowna branch road will afford transportation facilities necessary to the development of the gypsum deposits at Grande Prairie, which are owned by the Manitoba Gypsum Co. and said to be of enormous extent.

GOLDEN.—The Tarheel Copper Mines, Golden Mining Division, are reported to have passed out of the control of J. C. Lincke, a majority interest having been secured by Calgary business men. A company has been formed and it is proposed to proceed with development. A contract will be let for the driving of a 100-ft. cross-cut tunnel to tap the orebody. Transportation facilities are to be improved to the end that the ore may be hauled direct and by a shorter route to the Kootenay Central railroad at Parson Station. The Provincial government is constructing a road from Parson to open up the Spillimachene River district which, it is asserted, will be the natural outlet for the mineral of that region.

ONTARIO

A NEW MINISTER OF MINES.—GENERAL NEWS OF THE PROVINCE

As a result of the recent Provincial elections, at which a majority of representatives belonging to the Farmers' and Labor parties was returned, a new administration assumed office on November 10. A desirable re-arrangement was effected in connection with the Department of Lands, Forests and Mines. It has been felt for some time that the increased importance of the mining interest of Ontario justified the establishment of a separate department having charge of mining affairs. This has been carried into effect by the new government, and Harry Mills, elected for Fort William as a Labor candidate, has been appointed Minister of Mines. Any misgivings which might have been felt by mine operators or investors as to the adoption of too radical a policy, in view of Mr. Mills antecedents, have been set at rest by the assurances of the new minister given to the members of the Toronto branch of the Canadian Mining Institute. "My interest," said Mr. Mills, "is in the rapid development of the mineral resources of this Province, and in order to bring this about we must have capital. That is understood by all. I, for one, am going to see that every invitation I can give will be given toward that end, that we may have more capital and lots of it to develop our resources. I want you to dispel any fears you may harbor on that point."

COBALT.—The Lumsden mine, situated about one-quarter of a mile from the Temiskaming and Beaver, has been taken over by C. L. Campbell of Montreal. Arrangements have been made to thoroughly develop the property. The Mining Corporation of Canada, following recent negotiations, has secured an option on the adjoining Buffalo mine. Officials believe the consummation of a deal to be probable. The Buffalo was a pioneer in applying the oil-flotation process in the treatment of Cobalt ore. The cost of producing silver at the leading mines of Cobalt averages about 55 cents per ounce under present conditions. During October the Nipissing mine produced $375,000, establishing one of the highest records in its history.

The Penn-Canadian Co. is making a bid for the Bailey-Cobalt mine, and offers to merge with the latter on a fifty-fifty basis. The Bailey is also considering an offer from the Northern Customs Concentrator.

The Buffalo Mines has decided upon a further reduction in capital. Starting with 1,000,000 shares of the par value of $1 each, the company during the past two years returned 50 cents per share to its shareholders, thus reducing the capital to 1,000,000 shares of the par value of 50 cents each. It is now decided to pay another 35 cents per share and thus reduce the capital to 1,000,000 shares of the par value of 15 cents each.

PORCUPINE.—In the Porcupine gold area considerable difficulty is experienced in procuring men, and the Hollinger and Dome are working only at two-thirds capacity. According to an official, the report that an offer of $10 per share for control of the Hollinger had been made is without foundation. The new orebody encountered at a depth of 1500 ft. on the McIntyre-Porcupine is reported to have a width of about seven feet and assays show an average grade of $10 per ton in gold.

WEST SHINING TREE.—The Wasapika gold mine has acquired three additional mining claims adjoining each other to the north and carrying the extension of the Ribble vein on which the company is now working. This gives the Wasapika a mile and a half in all of the Ribble vein. The transaction made necessary a re-organization of the company with an increase of its capital from $3,000,000 to $6,000,000 in $1 shares. Of the total, 3,000,000 shares will be allotted to the present company, 1,000,000 will be applied to the purchase of the additional claims, and 2,000,000 will remain in the treasury. A large modern mill will be erected. A New York financial house has undertaken to provide funds for the development of the Atlas mine. An 8-ft. vein carrying visible gold has been found in the adit being driven from the lake level.

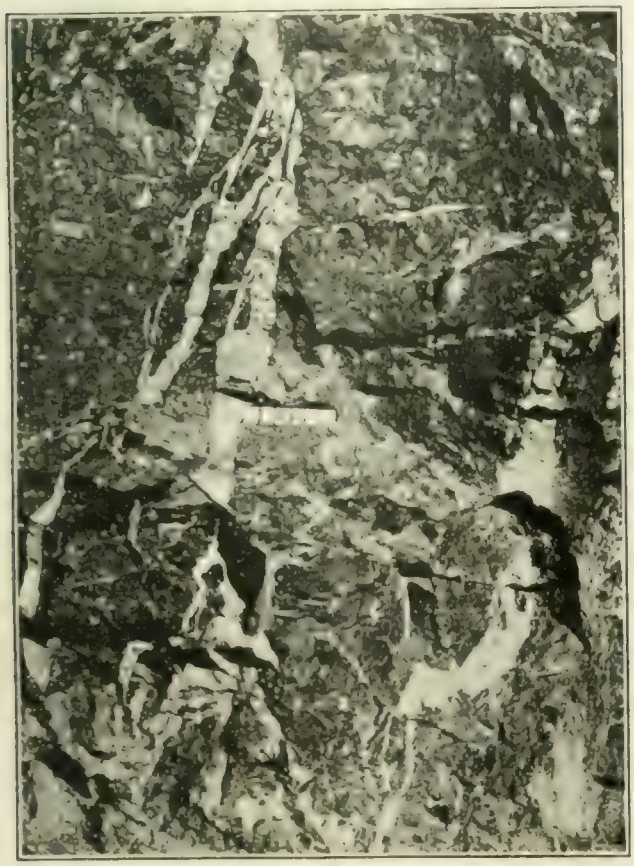
CHIHUAHUA

MANY PROPERTIES ARE RE-OPENING.

In six months, if present conditions continue, Chihuahua will be 'on top', in the belief of mining men, with big exports of ore and bullion. Francisco Villa, a few months ago the terror of the State, now is considered a negligible quantity, due to the active campaign conducted against him by General Manuel M. Dieguez. Lately Villa is said, on good authority, to have been

deserted by the greater part of his following. He was seen recently at a ranch near Parral with five followers. Mining men are preparing to re-open their properties in all parts of the State, while stocks of merchandise are being rushed. The scarcity of supplies in the country back of the railroads may be gathered from the fact that mining men report a pair of overalls worth a cow, and a spool of thread selling at a dollar gold. While Villa had any strength merchants were afraid to increase their stocks and as a result they were allowed to dwindle down to nothing, even in the larger places.

The Dolores mine, situated in the south-eastern part of Chihuahua on the Chihuahua-Sonora boundary, will be opened soon, a force having started for the property with supplies sufficient for a considerable period. This is a rich silver-gold mine, and had a large ore-reserve developed at the time revolutionary conditions forced a shutdown. The Tecolote property at Santa Barbara also is preparing to re-open, a force being at work cleaning up on the surface and getting things in shape for operation.



A TYPICAL OCCURRENCE OF SILVER-COBALT-CALCITE VEINS, COBALT, ONTARIO

Raoul DeFoureq is in charge. At Cusihuiriachic the Cusi Mining Co. is preparing to re-open all its properties, while preparations for resumption of operations are in evidence at Natividad and Ocampo and also at Jesus Maria, about 60 miles south of Temosachic. At the Terrazas mines, near Chihuahua City, preparations are expected to be started shortly for resumption of operations. Santa Eulalia is operating at as near capacity as the management can arrange. More mines are operating in the Parral district than at any time in the last eight years.

Better than anything else as an indicator of the return of confidence in the situation is the number of 'scouts' in the field for foreign interests. More men are looking for mining investments at the present time than at any time since the revolution started. At the same time resumption of mine operations is reflected by the demand for powder. Two large shipments have been allowed to cross the border recently at El Paso, one of 600 and the other of 800 boxes. Six months at least will be required to put many of the mining properties back on a producing basis, owing to repairs, lack of material, and the fact that several of those in the outlying districts have been worked systematically by 'gambecinos' or 'high-graders' during the absence of the owners. The high-graders worked without system, gouging out rich pockets and paying no attention to the average rock or to timbering. To repair this damage will require time and patience. The spirit of the people appears to be excellent, as they are anxious to work and rebuild their shattered fortunes. There has been much suffering on account of lack of necessary clothing, and in some districts where there have been excellent crops the people are going about in rags. No difficulty is being experienced in obtaining plenty of mine labor at reasonable rates.

SONORA

YAQUI INDIANS BEING PURSUED BY FEDERAL TROOPS.

Agua Prieta.—Col. Abram Fraijo, presidente municipal of Agua Prieta, has, with his associates, located what is claimed to be a large deposit of coal about 12 miles south of the international boundary. Analyses made by assayers in Douglas show the samples submitted by Colonel Fraijo to contain 57% fixed carbon.

Babiacora.—The Santa Ana property, on the Sonora river, is being operated under bond from N. S. Finch by Alfred Paul and J. V. Fryer. Recent discoveries of high-grade silver ore in a tunnel run under the old Spanish workings make the future of the property appear bright. Assays ran as high as 1300 oz. silver per ton. Yaqui depredations in that part of Sonora have interfered to some extent with plans of development of the property, chiefly by decreasing the efficiency of workmen, who are always on the alert for raiders, and by interfering with the transportation of supplies. A relatively small force is employed at the present time but more men will be added as room can be made for them underground. It is planned to erect a mill later.

Moctezuma District.—The Yaquis who were plundering in the eastern part of the Moctezuma district early in November have been driven southward into the Sahuaripa district, where at last reports several forces of Federal troops were converging upon them with the intention of effecting their capture or exterminating them. There are reported to be approximately 300 Indians in the main body, and between 1500 and 2000 Government troops are pursuing them.

CALIFORNIA

Colfax.—Unwatering the Rising Sun is proceeding. Electric power has been delivered by the Pacific Gas & Electric Co. and an electric pump of 400 gal. per min. has been erected.

Downieville.—James F. Hunt and associates are completing plans for resumption of work at the Gold Bluff and Oxford quartz properties, lately taken under bond and option. Both mines formerly yielded high-grade ore but have been worked intermittently in late years.——The shaft of the Strand & Nelson gravel property, near the Kirkpatrick group, has entered sand and is believed to be near the channel. The vertical shaft was sunk from a 100-ft. incline and follows the bedrock.

Grass Valley.—Recovery of the noted 'gambler's' lode on the western edge of Grass Valley has been announced by the Boundary Gold Mines Co. A strong vein, carrying visible gold, was found at 80 ft. Work for the recovery of the lode has been under way for two years.

Placerville.—Some of the operating mines inspected last week by J. W. Gebb, mine inspector for the State Industrial Accident Commission, were the Hook and Ladder, Ohio, Roundout, and Pacific deep gravel mines east of Placerville, and the property of the El Dorado Lime & Minerals Co., about twelve miles south-west.

San Andreas.—Repairs to the pipe-line at the Comet have been completed and arrangements made to place the compressor and mill in commission. Unwatering the winze from the lower tunnel is to be undertaken and sinking resumed. Future plans include addition of new equipment to effect a closer gold saving from refractory ores. Allen Doe is manager.——The Corn Meal group, near West Point, has passed under bond to E. E. Sellick, H. W. Post, and Fred Walker of Stockton, and New York people. Good ore is reported exposed near surface.

Sierra City.—Operations at the Cleveland and Monarch Consolidated, controlled by the R. G. Gillespie interests of Pittsburgh, Pennsylvania, are proceeding more satisfactorily than at any time in many years. Ore of excellent grade has been opened on the lower level of the Monarch Consolidated, and the 20-stamp mill is running steadily. At the Cleveland good ore is exposed and development of new ground is proving extension of the main veins. S. E. Montgomery is consulting engineer.

Taylorsville.—The Gruss Mining Co. plans driving a cross-cut from the 400-ft. level of the Gruss mine 1000 to 1500 ft. on a copper orebody. The shaft is to be deepened 200 ft. and a lateral driven from this point. The present stamp-mill is to be re-modeled and provided with flotation equipment. W. J. Gruss is general manager.

COLORADO

Idaho Springs.—A lease syndicate composed of W. O. Reynolds, president of the Hibernia Bank & Trust Co., W. [illegible], F. A. Reiser and A. P. Arnold has acquired the [illegible] group of two [illegible] and a placer claim, and it is understood is preparing to undertake their development. The group lies south-west from the Shafter, and is connected through that property with the Big Five tunnel. The Refugee was at one time a producer of high-grade ore, but has been long inactive. Lieut. Aroudel, it is stated, will have charge of the proposed development.

IDAHO

Coeur d'Alene.—Normal production for all the producing mines of the Coeur d'Alene by December 1 is predicted by those in touch with the mining industry of the district. Slightly more than a month has elapsed since the strike of the International Union of Mine, Mill and Smelter Workers was called off on October 8 and all the mines affected have resumed operations at both mine and mills, and the normal production of the district is rapidly being approached.

Wallace.—The Federal Mining & Smelting Co. has declared a quarterly dividend of ½ cent per share on its preferred stock. This is equivalent to $60,000 on the issue of 120,000 shares. The disbursement will be made on December 15 to stockholders of record on November 25.

NEVADA

Austin.—According to interested parties negotiations are pending for the sale of the Nevada Birch Creek group, Birch Creek district, to a syndicate represented by Harry Stimler, of Tonopah, C. D. Wilkinson, of Goldfield, and other prominent operators. The Nevada Birch Creek comprises a group of claims located on the Cahill lode, discovered three months ago by Jack Cahill. Streaks of free-gold ore have been found in the upper tunnel at a depth of 50 ft. and the driving of a lower tunnel is proceeding to tap the lode at a depth of 150 ft. This tunnel is in 260 ft. and a cross-cut will probably be extended to the orebody.——Sinking is proceeding steadily at the South Extension group of the Cahill Lode Co. and Jack Cahill, the manager, expects to reach the vein shortly after passing through the porphyritic cap-rock, supposedly about 30 ft. thick at this point.

Goldfield.—A. W. L. Dunn and associates have acquired the General Washington mine, south of and adjoining the Cracker Jack. The property is to be developed from the 320-ft. level of the Cracker Jack shaft and cross-cuts driven to seek the extension of the Cracker Jack vein-system.——Driving the cross-cut from the 440-ft. level of the Cracker Jack has been resumed for the purpose of intersecting the orebody east of the present workings. In the bottom of the winze the vein assays $30 per ton. It has been opened for a length of 120 ft. north and south of the raise above the 440-ft. level and averages 10 ft. wide with assays averaging around $18 per ton.——The Dunn lease, in the old Engineers section of the Florence-Goldfield, has exposed an ore-shoot 10 to 20 in. wide sampling $130 per ton. A shipment is being prepared. The Adamson-Traynor-McCall and Florence Divide leases are shipping regularly.——The Goldfield Development reports excellent ore on the north half of the Florence-Goldfield, which is being worked under long lease.——Red Hills-Florence has opened an ore-shoot assaying $70 south of east-west fault in the Florence-Goldfield.

Reservation.—The Review Silver M. Co. has acquired the Review group of five claims and arranged for driving a 750-ft. tunnel. Orders have been placed for a compressor

and other equipment. The property adjoins the V-7 group on the south and is controlled by George W. Howell and associates of Oakland.——Elkton Divide has taken a lease on the Pinto claim of the Reservation Hill and is arranging for development of a vein of high-grade silver-lead ore. A substantial stock interest in this company has been taken by Boston and New York people.——Nevada Silver M. & D. Co. has begun work on the Dog group of six claims, south of the V-7 property.——The entire field is attracting wide attention and promises soon to become one of the important silver-lead-gold fields of Nevada. W. E. Casson, of Carson City, is heavily interested in most of the active companies.

Rochester.—An Oliver filter has been added to the Rochester mill and 100 to 150 tons of ore are going daily through the plant. Mill-heads are said to be averaging 10 oz. silver and $2 gold. Development in the lower workings continues to expose good ore.

WASHINGTON

Colville.—The old Dominion mine east of Colville, famous in the annals of the north-west as a silver producer, will be re-opened within 60 days, according to word from Colville. It has been closed most of the time for 20 years. W. H. Linney will be in charge.

Stevens County.—The Copper Blossom group of 80 acres, six miles east of Valley, has been acquired by Evan Morgan for himself and associates under a bond from H. A. Van Buskirk of Hope, Idaho. Mr. Morgan was mine manager for the Loon Lake Copper Co. in the period of dividend payments. The property lies on the Chewelah-Loon Lake copper belt and between the United Silver-Copper and the Loon Lake mines, which are several miles apart.

BRITISH COLUMBIA

Fort Steele.—Spokane men are chief owners in the Victor-Silver Leaf Mining Co., which has given a lease to George Gundry of Spokane on its property on Mouse creek in the Fort Steele district. Mr. Gundry has returned from the East, where he is said to have secured financial backing, and will proceed with development and equipment plans. He has ordered equipment for a 50-ton concentrator, to be built at once, and within 30 days from the time the machinery arrives he hopes to be turning out concentrates.

Trail.—The Consolidated Mining & Smelting Co. received 4233 tons of ore in the first seven days of November. This is about the average of other recent weeks. The receipts in detail follow:

Mine	Gross tons
Alamo Mill, Alamo	90
Bluebell, Riondel	94
Donohue, Nicola	8
Gentry, Cottonwood, Idaho	34
Highland, Cedar Creek	70
Josie, Rossland	249
Loon Lake, Loon Lake	25
Mandy, The Pas, Manitoba	65
Maestro, Cedar Creek	23
North Star, Kimberley	276
Queen Bess, Sandon	48
Rossland Mines, Rossland	2319
Ruth, Cedar Creek	115
Rambler, Rambler	235
Sitting Bull, Athalmer	13
Spokane Trinket, Ainsworth	45
St. Eugene, Moyie	44
Standard, Silverton	293
Strobeck, Chewelah	33
Trojan, Athalmer	22
Whitewater, Retallack	32

Personal

The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

Oscar Lachmund is at Spokane.

D'Arcy Weatherbe is at Peking.

W. E. Simpson has returned from London to Cobalt.

J. B. Tyrrell has been examining mines in Eastern Manitoba.

Hallet R. Robbins has arrived in San Francisco from New York.

C. A. Banks has opened offices at 5 Nelson Court, Vancouver.

R. H. Stretch, of Seattle, is taking a holiday in Southern California.

D. V. Baron, owner of a group of claims at Oatman, is in New York.

H. D. Quimby, from Chewelah, Washington, is here on his way to Mexico.

Will H. Coghill is with the U. S. Bureau of Mines, at Golden, Colorado.

R. C. Gemmell has returned to Salt Lake City after a trip to Duluth and Chicago.

J. Mackintosh Bell has opened an office as consulting mining engineer at Toronto.

Willet G. Miller, Provincial Geologist of Ontario, has returned to Toronto from London.

J. W. D. Moodie, vice-president of the Britannic M. & S. Co., British Columbia, has been at Salt Lake City recently.

Frank Merricks has accepted the nomination to the presidency of the Institution of Mining and Metallurgy, in London.

Horace V. Winchell, president of the Institute, is expected in San Francisco on December 22, when he will address the local section.

Edel Moldenke, mining engineer, has returned to Watchung, New Jersey, after spending two years with the Burma Mines, in Burma.

Fred B. Ely has accepted a position in the geological department of the Pierson Oil Co., with headquarters at Shreveport, Louisiana.

H. C. Goodrich, chief engineer for the Utah Copper Co. and Bingham & Garfield Railway Co., has returned to Salt Lake City from Los Angeles.

A. G. Mackenzie, secretary of the Utah Chapter of the American Mining Congress, attended the annual meeting of that organization at St. Louis.

A. G. Burritt, mining geologist of Salt Lake City, is making an examination of oilfields in Louisiana, Oklahoma, and Arkansas for Eastern capitalists.

E. Gybbon Spilsbury is on his way to Brazil to study the question of establishing steel works in that country. He expects to be absent until February.

J. H. Lewis has left the Braden Copper Co., at Rancagua, Chile, where he was employed as assistant mill-superintendent, and is now at Spokane, Washington.

James G. Parmelee, recently research metallurgist with the School of Mines in co-operation with the U. S. Bureau of Mines, at Moscow, Idaho, is now connected with the Hardinge Conical Mill Co. at Salt Lake City.

Joseph B. Umpleby has resigned as geologist in charge, Section of Foreign Mineral Deposits, U. S. Geological Survey, to accept the position of Professor of Geology and Director of the School of Engineering Geology in the University of Oklahoma, at Norman.

THE METAL MARKET

METAL PRICES

San Francisco November 25

Aluminum dust, cents per pound	65
Antimony, cents per pound	10.00
Copper, electrolytic, cents per pound	20.00
Lead, pig, cents per pound	7.00—8.00
Platinum, pure, per ounce	$140
Platinum, 10% iridium, per ounce	$160
Quicksilver, per flask of 75 lb	$75
Spelter, cents per pound	9.50
Zinc dust, cents per pound	11.00—13.50

EASTERN METAL MARKET

(By wire from New York)

November 25.—Copper is inactive and weak. Lead is quiet and firm. Zinc is dull and easy.

SILVER

Below are given official or ticker quotations in cents per ounce of silver 999 fine. From April 23, 1918, the United States government paid $1 per ounce for all silver purchased by it, fixing a maximum of $1.01½ on August 15, 1918, and will continue to pay $1 until the quantity specified under the Act is purchased, probably extending over several years. On May 5, 1919, all restrictions on the metal were removed, resulting in fluctuations. During the restricted period, the British government fixed the maximum price five times, the last being on March 25, 1919, on account of the low rate of sterling exchange, but removed all restrictions on May 10. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the normal rate of exchange.

		New York cents	London pence		Average week ending	Cents	Pence
Nov.	19	127.00	70.50	Oct.	14	117.44	62.83
	20	127.00	71.25	"	21	117.95	63.98
	21	142.87	73.50	"	28	119.37	64.45
	22	144.00	74.00	Nov.	4	122.20	66.16
	23 Sunday			"	11	124.32	67.22
	24	135.00	75.50	"	18	125.73	68.81
	25	136.25	76.00	"	25	131.93	73.46

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	75.14	88.72	101.12	July	78.92	99.62	106.36
Feb.	77.54	85.79	101.12	Aug.	85.40	100.31	111.35
Mch.	74.13	88.11	101.12	Sept.	100.73	101.12	113.92
Apr.	72.51	95.35	101.12	Oct.	87.38	101.12	119.10
May	74.61	99.50	107.23	Nov.	85.97	101.12	....
June	76.44	99.50	110.50	Dec.	85.97	101.12	....

COPPER

Prices of electrolytic in New York, in cents per pound.

Date			Average week ending	
Nov.	19	20.00	Oct. 14	21.72
	20	19.75	" 21	21.87
	21	19.50	" 28	21.75
	22	19.25	Nov. 4	21.37
	23 Sunday		" 11	21.10
	24	19.25	" 18	21.36
	25	19.12	" 25	19.48

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	29.53	23.50	20.43	July	29.07	26.00	20.82
Feb.	34.56	23.50	17.34	Aug.	27.42	26.00	22.51
Mch.	36.00	23.50	15.05	Sept.	25.11	26.00	22.10
Apr.	33.18	23.50	15.93	Oct.	23.50	26.00	21.66
May	31.09	23.50	15.91	Nov.	23.50	26.00	....
June	32.57	23.50	17.53	Dec.	23.50	26.00	....

LEAD

Lead is quoted in cents per pound, New York delivery.

Date			Average week ending	
Nov.	19	6.75	Oct. 14	6.25
	20	6.75	" 21	6.43
	21	6.75	" 28	6.66
	22	6.75	Nov. 4	6.75
	23 Sunday		" 11	6.75
	24	6.75	" 18	6.80
	25	6.75	" 25	6.75

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	7.64	6.85	5.60	July	10.94	8.03	5.53
Feb.	9.10	7.07	5.14	Aug.	10.25	8.05	5.78
Mch.	10.07	7.06	5.04	Sept.	9.07	8.05	6.02
Apr.	9.28	6.90	5.06	Oct.	6.97	8.05	6.40
May	10.79	6.88	5.04	Nov.	6.48	8.05	....
June	11.74	7.09	5.32	Dec.	6.40	6.90	....

TIN

Prices in New York, in cents per pound.

	1917	1918	1919		1917	1918	1919
Jan.	44.19	84.13	71.50	July	69.69	93.00	70.11
Feb.	48.47	84.56	72.44	Aug.	67.34	91.54	62.20
Mch.	54.57	84.62	71.00	Sept.	64.34	80.40	55.79
Apr.	58.66	84.62	71.00	Oct.	62.24	78.87	54.82
May	64.64	84.62	70.00	Nov.	64.18	73.67	....
June	61.04	91.69	71.83	Dec.	85.09	71.92	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound:

Date			Average week ending	
Nov.	19	8.25	Oct. 14	7.72
"	20	8.15	" 21	7.89
"	21	8.15	" 28	8.10
"	22	8.10	Nov. 4	7.92
	23 Sunday		" 11	7.97
"	24	8.10	" 18	8.28
"	25	8.20	" 25	8.16

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	9.75	7.78	7.44	July	8.98	8.72	7.78
Feb.	10.45	7.97	6.71	Aug.	8.58	8.78	7.81
Mch.	10.78	7.67	6.53	Sept.	8.33	9.58	7.57
Apr.	10.20	7.04	6.49	Oct.	8.32	9.11	7.82
May	9.41	7.92	6.43	Nov.	7.76	8.75	....
June	9.63	7.92	6.91	Dec.	7.84	8.49	....

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. Prices, in dollars per flask of 75 pounds:

Date			Date		
Oct.	28	85.00	Nov.	10	80.00
Nov.	4	80.00	"	18	80.00
			"	25	75.00

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	81.00	128.06	103.75	July	102.00	120.00	100.00
Feb.	126.25	118.00	90.00	Aug.	115.00	120.00	103.00
Mch.	113.75	112.00	72.80	Sept.	112.00	120.00	102.60
Apr.	114.50	115.00	73.12	Oct.	102.00	120.00	86.00
May	104.00	110.00	84.80	Nov.	102.50	120.00	....
June	85.00	112.00	94.40	Dec.	117.42	115.00	....

MONEY AND EXCHANGE

It is beginning to be realized more and more by international bankers that not for many years will the foreign exchanges be restored to normal levels. It is customary in some quarters to ascribe the present discount on rates as due to the adverse trade balances of European countries, but keen students of the situation say the fundamental factor is the domestic state of finances in those countries, or more specifically, the depreciation of their respective currencies. When gold payment, including export of gold is resumed, the currency depreciation will disappear. Some idea as to time of that resumption may be gathered from the fact that this country did not resume specie payments after the Civil War until 1879.

When the ban on trading in marks was lifted several months ago there began a steady decline in the rate from about eight cents until 3.15 cents was reached last month. A subsequent recovery brought the price back to 4¾ cents, but since then the mark has receded to 2.05 cents. There are several reasons which preclude an early recovery in this exchange, according to usually well-informed quarters. One is the highly speculative position. Many people bought the exchange in expectation of a quick profit which has not been realized, and they are likely to sell out on any material advance. The most important factor, however, is the large import of raw materials into Germany, and the fact that Americans are no longer buying marks as eagerly for speculative purposes as they did a month ago.

Now and then surprise is expressed that exchange rates on the Scandinavian countries have not led to importations of gold to the United States from that quarter, since the ruling discounts greatly exceed the cost of bringing the metal over. But the reason is not far to seek. It lies in the fact that those countries are somewhat in the same position as the late belligerent countries whose exchanges are also heavily depreciated.

The following table gives the amounts of foreign government and city loans floated in this country since the Armistice, with dates of maturity, interest rates, and offered prices:

Government of:	Amount	Maturity	Rate	Offered
Canada	$75 000 000	Aug. 1, 1921	5½	99¼
China, Republic	5,500,000	Nov. 1, 1921	6	98½
		Aug. 1, 1929		97
Newfoundland	5,000 000	July 1, 1939	5½	100
Switzerland	30 000 000	Aug. 1, 1929	5½	96¼
United Kingdom	250,000,000	Nov. 1, 1922	5½	98
		Aug. 1, 1929		96¼
City of:				
Bordeaux	15 000 000	Nov. 1, 1934	6	92½
Copenhagen	15 000 000	July 1, 1944	5½	93½
Lyons	15 000 000	Nov. 1, 1934	6	92½
Marseilles	15 000 000	Nov. 1, 1934	6	92½
Rio de Janeiro	10 000 000	May 1, 1922	6	98⅝
		1931		95⅞
Sao Paulo	8 500 000	Nov. 1 1943	6	95½
Sweden	25 000 000	June 15 1939	6	99½
Total	$489 000 000			

Quotations on November 25 are as follows:

Sterling:	Cable	4.07
	Demand	4.06
France:	Cable	9.69
	Demand	9.71
Lire	Demand	11.80
Marks		2.80

Eastern Metal Market

New York, November 19.

The markets are featureless and uninteresting. Demand in all cases is light and the price in most metals is downward.

On poor demand and freer offerings copper quotations have receded.

The tin market has been quiet with little inquiry or buying. Prices are easier.

A development of strength characterized the lead market, but demand is light. Prices are a little higher.

The zinc market is dull but fairly steady and firm.

Antimony is higher.

IRON AND STEEL

The prospect that the difficulty in securing supplies will increase rather than diminish for some months dominates this market. Further advances have been experienced in pig-iron, about $2 per ton in steel-making grades and $1 to $2 for foundry irons, and large sales are reported, chiefly for the first and second quarter of next week. In fact, much iron could be sold except for the fact that several makers have withdrawn from the market. Resumption of 10 to 12 blast-furnaces is reported. There have been sales of Canadian pig-iron to melters in the United States also. There are estimates that the railroads will buy 1,000,000 tons of rails when they are turned back. Recent sales for exports include 20,000,000 boxes of tin plates at $8 and several thousand tons of rails. There is a marked shortage of sheets and automobile makers are building up prices, as high as $30 premium having been offered.

COPPER

It is generally understood that some of the large producers have been recently sounding consumers at considerably lower levels than have prevailed. It is evidently realized that production is in excess of consumption and has been for some time, and that unless sales are stimulated a curtailment in output will be necessary. Offerings as low as 20c., New York, for electrolytic copper for delivery this year are reported, which contrasts with 20.75c. to 21c. a week ago. It appears that the smaller producers and the speculators or dealers are also making similar offerings. The market may therefore be described as quiet and lower with electrolytic quoted at about 20c. to 20.25c., New York, for early or this year's delivery, with Lake copper at 20.50c. to 20.75c., New York. Very little business has thus far resulted, it is understood. Exports for the first nine months have been about 19,200 tons per month with imports at about 15,400 tons per month. Consumption is being rather reduced than otherwise, and the future of the market is uncertain, buying for export being a factor hard to predict.

TIN

The week has been a quiet one. Only light sales have been made for either prompt or future shipment. This has been a disappointment to many, as the official ending of the coal strike was expected to result in plenty of business. It is possible that the big men, however, knew that the 'official' ending was not a 'real' ending of the strike. On some days the price of spot Straits tin has been higher than previously, due to congestion at the docks. Prices have been as high as 54.50c., New York, the latter part of last week. Today, however, spot Straits can be bought at 53.82½c., New York, with metal ex-steamer at dock at 53.25c. The last quotation for December-January shipment from the East was 53.50c. It is evident that the pressure of large supplies has not remedied the situation. The market is entirely featureless. Thus far this month arrivals have been 1365 tons, with the quantity afloat 5340 tons, which is still relatively large.

LEAD

The market has developed some strength but there has been no large demand recorded. The stronger market is due more to a limited supply rather than to increased demand. Some selling agencies are asking close to 7c., New York, but it is believed that this is extreme and without significant meaning. It is rumored but not confirmed that the leading interest may not be selling at its present quotation of 6.75c., New York, and 6.50c., St. Louis. We quote the market as 6.80c., New York, and 6.55c. to 6.65c., St. Louis, for early delivery.

ZINC

Since the report of last week the market experienced an advance to the 8c. St. Louis level, due largely to a better demand for export, especially by way of Southern ports, and to other causes. At this level the larger producers were more interested and did some business, it is reported. Since then, however, the market has eased off slightly to 7.95c., St. Louis, or 8.30c., New York, for prime Western for this year's delivery and has again become quiet. Domestic buying is not a large factor and the future is uncertain. Galvanizers are evidently not attracted by the present levels, perhaps considering these high in view of past prices. At any rate they are probably provided for at present. The demand for export has again eased off.

ANTIMONY

The market is stronger and demand is better with Asiatic grades quoted at 9.25c., New York, duty paid, for wholesale lots for early delivery.

ALUMINUM

Virgin metal, 98 to 99% pure, is still quoted at 32c. to 33c., New York, for wholesale lots for early delivery.

ORES

Tungsten: The market continues quiet, but a little business is reported. The tariff is the controlling factor and not much activity is expected until this is cleaned up. Some South American ore has sold at $10 per unit. Other ores, such as Chinese and Bolivian, are quoted at $7 to $10 per unit. Ferro-tungsten has not been tested, but is probably obtainable around $1.25 per lb. of contained tungsten.

Molybdenum: Quotations are nominal at 75c. per lb. of MoS_2 in 90% material. No business has been heard of.

Manganese-Iron Alloys: The spiegeleisen market is active and strong at $35, furnace. There have been sales of several thousand tons for domestic and foreign consumption, and inquiries for both deliveries run into the thousands of tons, perhaps up to 5000 tons. No British ferromanganese is in the market at present for any delivery, but there are sales of small lots of domestic alloy up to 300 tons each at $110, delivered, for this and first quarter delivery, with inquiries totaling 1000 tons. The market is quiet but firm.

Unless copper sales improve considerably within the next three weeks, copper companies will begin to curtail output drastically. Large producers wish to keep their working organizations together, but they are beginning to believe that it will take much longer to get Europe back to normal than was at first expected, in spite of certain plans that are expected to hasten German buying.

INDUSTRIAL PROGRESS

INFORMATION FURNISHED BY MANUFACTURERS

THE MINERS' 'HARD BOILED' PROTECTIVE CAP

The latest addition to the safety department of E. D. Bullard, of San Francisco, is a miners' 'hard boiled' cap that is blow-resisting, fire and water-proof, and a non-conductor of electricity. This is a safety device that has been long looked for by miners and mining companies. It will prevent head injuries from falling ground and projecting ledges, as well as from low trolley wires and exposed power lines.

The new cap will prove a great benefit to mining companies from a purely monetary standpoint, because of its tremendous strength and durability, which will make it outlast a dozen or more of the old duck lamp-cap, and particularly because it will practically eliminate accident compensation for head injuries to employees.

A blow of sufficient force to break the 'hard boiled' cap would cause a fracture of the skull of an unprotected miner,

Two Views of the 'Hard Boiled' Cap

or one wearing the old style duck cap. By actual test a 20-lb. iron weight dropped two feet upon the cap (the cap lying upon a solid concrete floor) did not break it at any point. A one-pound bolt dropped forty feet struck squarely on the crown of the cap (on the head of a workman), barely dented it and in no way injured the wearer.

The cap is entirely water-proof and a perfect non-conductor of electricity; weighs but seven ounces, and is as comfortable to the wearer as any hat or cap can be. As for durability, the trial period of 18 months to which the first experimental caps were subjected left them all in good wearable condition. It has a false top and the air space between this and the true crown of the cap is filled with a soft [illegible] material and the [illegible] by the design makes the top practically unbreakable. The strong canvas lining of the cap is provided with a draw-string in the crown by means of which the comfortable set of the cap upon the wearer's head is assured; this device also adds to the shock-absorbing capacity of the cap.

The 'hard boiled' safety cap carries the regulation bracket for the carbide cap-lamp and will be supplied in every desired size.

Taking it all in all, the 'hard boiled' cap is a big step forward both in safety and economy.

BUTTE WATER COMPANY

In 1892, the Redwood Manufacturers Co. installed a line of Remco continuous-stave redwood pipe 46,000 ft. in length and 24 in. diameter from a reservoir in the mountains to a connection with the city system of Butte. The pipe operates under 160 ft. static head. One of the peculiarities is that the water is pumped from the streams on the Atlantic side of the continental divide to a reservoir on the Pacific side, and that the water, which, if allowed to take its natural course, would flow into the Gulf of Mexico, actually, after flowing through the pipe, reaches the Pacific ocean.

In 1899, the Redwood Manufacturers Co. installed for the Butte Water Co. 64,700 ft. of 24-in. Remco continuous-stave redwood pipe and 32,600 ft. of 26-in., which was an additional supply-line for the city of Butte. This line runs from the Big Hole river to a connection with the city system on the outskirts of Butte, and is under a pumping pressure averaging 200 ft. static head.

In October 1919, the Butte Water Co. awarded a contract to the Redwood Manufacturers Co. for 24 miles of 26 and 24-in. Remco continuous-stave pipe for additional water supply. This line also runs from the pumping plant on the Big Hole river to a connection with the city system, and will be installed in the summer of 1920.

Eugene Carroll, one of the foremost hydraulic engineers of the United States, was general manager for the Butte Water Co. in 1892 when the first line was installed, and has been so continuously since.

The lines installed in 1892 and 1899 were thoroughly examined in October 1919, and found to be free from any deterioration whatever. The redwood shows no decay and is in its original condition. The pipe-lines have never ceased operations for a single day since they were installed, notwithstanding the fact that they are situated in a locality where the temperature goes 50° below zero at times, winter conditions being severe at all times.

For the 28 years of its existence, the original line has supplied the city of Butte and the big mines therein with water, and has never failed to deliver it, nor has the line built in '99 caused any delay.

The awarding of the contract in 1919 by Mr. Carroll is sufficient evidence of his opinion of the quality of Remco pipe. Mr. Carroll will be glad to give any person interested in the details a complete record of these two famous lines.

James A. Lannon, formerly general superintendent for the Atlas Mining & Milling Co. of Ouray, Colorado, has associated himself with the Denver Engineering Works Co., the Aldrich Pump Co., and the Victor M. Braschi Machinery Co. of Mexico City, as their representative and will have headquarters at Mexico City with the Braschi Machinery Co.

AMONG American mining enterprises abroad, we note the South American Gold & Platinum Co., a prospectus of which has been sent to us by the well-known brokers, Weir Brothers & Co., of New York. The directors include Messrs. Adolph, Frederick, and Sam Lewisohn, together with Messrs. J. Parke Channing and A. F. Keene. The mines are in the Choco province of Colombia, on the San Juan and Condoto rivers, where the Consolidated Gold Fields of South Africa, through a subsidiary company called the Anglo-Colombian Development Company, Ltd., has been operating with some success since 1911. The present venture marks the absorption of the British company by the one in New York and indicates the raising of American capital for the purpose of building new steel dredges and otherwise placing the enterprise on a better engineering basis.

FROM the Federal Trade Commission's report, we get the total $672,168,916 as the capital invested in American copper-mining enterprises. On this, 28% was made in 1918. The results for the current year, it is safe to say, will be considerably smaller. In Mexico and South America $95,854,812 is invested in six companies, including the Chile, Braden, Cerro de Pasco, and Greene-Cananea properties. The companies in Arizona and New Mexico represent an investment of $255,588,541 and a return of 31.7%, but it is a group of 22 companies, not distributed geographically, that shows the best return, namely, 69.3% on an aggregate capital of $10,527,387. The Michigan group has invested the sum of $74,615,578, on which only 21.3% was paid last year. Of the total American production, 38.3% came from Arizona and New Mexico; in these States 30 companies were contributory.

THE unfortunate plight of the gold-mining industry has been emphasized again, this time by some of the members of the British Columbia Chamber of Mines. In recognition of the fact that, since taxes were last adjusted, mining costs have doubled, while the worth of the product remains the same, a committee has been formed representing the Chamber of Mines, the Canadian Mining Institute, and the mine-owners, for the purpose of investigating the matter and making a report before the next session of the Legislature. We are reminded of the resolution before the American Mining Congress, to tax gold used in manufacture and the arts at $10 per ounce for the benefit of the producers, and of the 15% premium being paid on gold produced by the South African mines. If the present costs, which are disastrous to the marginal group of mines, persist, it will become necessary for this country to face the issue squarely.

NO definite result has ensued as yet from the diplomatic correspondence between Washington and the alleged government of Señor Carranza, but "last straws" are accumulating rapidly, and in time there will be enough of them to make it comfortable for Don Venustiano to lie down. We suspect that he is looking for a chance to slip out of Mexico with the proceeds of his dictatorship and retire to Madrid or Paris, joining the company of other so-called Spanish-American ex-presidents, governors, and generals, for whom their home land has become too hot. It is unlikely that he will allow the Jenkins affair to go too far. Having sent one or two sneering notes to our Secretary of State, he will release Mr. Jenkins and let the matter drop. Then we shall have another 'incident', meaning that another of our people will be robbed or murdered. Some day the end will come, but not yet.

KOLCHAK'S defeat and his evacuation of Omsk is much to be regretted, for to him those engaged in mining operations in Siberia were looking for a restoration of orderly government in that immense mineral territory. His army evidently has been badly beaten by the Bolshevist forces and has been compelled to lose a large stock of munitions, railroad equipment, and other valuable supplies. We hope to hear that the few American and British engineers remaining at the mines have been able to escape the oncoming Red wave. In our issue of October 11 we summarized conditions in Siberia in their relation to the Anglo-American mining enterprises and explained how work was still proceeding hopefully at Kyshtim, Ridder, and Ekibastus. These settlements must now be in the hands of the Bolshevists, and the faithful Kirghiz will have left the mines for their homes in the open steppe, where safety lies. It is remarkable that despite the desperate condition of affairs in Siberia during the last two years, the shares of the Russian companies registered in London should have held so firmly. For instance, according to 'The Financial Times' of November 13, the principal stocks were quoted as follows, in pounds sterling: Irtysh 1⅝, Kyshtim 1⅝, Lena Goldfields 1½, Russo-Asiatic 4½, Sissert 1⅛, Spassky 1⅞, and Tanalyk 1½. It would seem to us that the destruction of property and the probable delay in the resumption of

operations should have depressed the market more than it appears to have done, but we regard the firmness of the share market as evidence of the courage and tenacity of the proprietors—qualities that we hope and expect to see amply rewarded in the near future, when Siberia emerges from chaos.

IN our last issue we mentioned Mr. Loring's name in connection with the great Burma mine. It is interesting to note his success in re-opening and developing the old Morgan and Calaveras groups of claims on Carson Hill, at the southern end of Calaveras county, which, of course, is in the belt known as the Mother Lode of California. The successful expansion of this mining enterprise is highly gratifying to Californians and to the Boston shareholders of the Carson Hill Gold Mining Co. During the first nine months of the current year the company has mined and milled 59,725 tons of ore yielding $13.55 in bullion. Since midsummer Mr. Loring has been opening up the deepest level, at 865 feet, where for a length of 135 feet and a width of 25 feet the ore averages $50 per ton. The ore assured is estimated at 210,000 tons averaging $28 per ton, or $5,880,000 gross. The total cost of realization is stated to be $16 per ton. The Calaveras Consolidated, which is now part of the Carson Hill property, belonged to an English company, which operated a 20-stamp mill twenty-five years ago. This part of the property is on the Mother Lode itself, whereas the Morgan orebody is in a parallel vein. Mr. Loring expects the Calaveras ground to yield a large tonnage of $5 to $7 ore, similar in grade and character to that mined in Amador county, where he has re-opened the Plymouth mine so successfully in behalf of his British clients. We like to see the native son returning from foreign parts and succeeding in developing the mineral resources of his own State.

IT may well be that the present deadlock over a settlement of wages for the coal-miners will result in legislation that will prevent combinations of unions to enforce their demands by nation-wide strikes, or by any strikes that extend beyond the district primarily involved. The Government long ago passed laws forbidding combinations in restraint of trade, the intent being to prevent corporations, that is, Capital, from combining so as to throttle competition and victimize the consumer. There is no reason why Labor should be immune from restraining legislation that would in a similar way restrict its power, and prevent attempts, such as the one we are now witnessing by the coal-miners, to enforce demands by bullying the entire country. The local strike is in many cases the only way in which employees can protect themselves against the oppressions of unscrupulous employers, and when necessary it is a weapon the use of which receives public sanction. The nation-wide strike does not fall in the same class; inevitably it involves many districts where the men have no grievances; its logical accompaniment is the sympathetic strike, a still more vicious method of attempting to coerce unreasonable employers at the expense of the public at large. The issue has become quite clear during the progress of the coal strike, and the support accorded the Government by the nation has shown the trend of public opinion. No group, no matter how well organized, can fight the entire country for long. Organized labor, by its foolish advocacy of the nation-wide strike, and its futile threats, which are now becoming common, to "tie up the whole country", is bringing about the curtailment of its own power. One of the most obvious weaknesses in human nature is not knowing where to stop; organized labor, which has benefited the condition of the working-man to a great degree, is showing evidence now of this weakness; the unions, through repeated victories, are fast reaching the condition of foolish pride that precedes a fall. We believe that Labor, if it is wise, will hold fast what it has won, and through moderation and fair dealing continue to retain that public support which has been responsible in the past for the successful assertion of its just rights. Otherwise, it will prove to be its own worst enemy; arrogant with power, it will overstep the bounds, as kings and princes have overstepped them since the dawn of history, then an exasperated and sorely-tried public will arise in resentment and bring the entire edifice of unionism to the ground.

BY courtesy of a friend in Arizona, we have received a copy of a remarkable report on a copper mine. We believe that it was written in good faith; therefore we shall not pillory the perpetrator, nor mention the name of the alleged mine. Among other items of valuable information given in this report we note that "the fisher veins are chiefly divided into schist and gneiss . . . The chief mineral changes are the re-crystallization of feldspar and the production of muscobite quartz and actionite." The presence of the last of these is undoubtedly a sign of secondary enrichment. Next we learn that "most beds containing organic matter give off a certain amount of sulphurated hydrogen; in fact, certain schales and limestones have this peculiarity. We call it fatid limestone, and limestone is plentiful on this property; also I find schale and iron causes of ore precipitation." We have heard of the wise old fellows of the days gone-by that had "a good nose for ore"; now we know how it happened. "A strong iron cap is a shure sign of a large ore body underneath," he says. Again, "a strong iron cap is proof of a large ore body." Some element of truth in this, but over-done, is it not? "There is about 10 claims of this property that is iron capping and on those claims the ore assays 14 and 15 per cent copper and some places in gold, also plenty wood and water, on this property there is three contacts on this iron capping that is diorite and rhyolite, and one dike of lime that has not been broken up." And it never will be, for like King Arthur's city, which was built to music, and therefore was never built at all, it was made for ever, and could not be broken by the forces of nature or the blows of fact. We hazard the guess that the "wood and water" are more likely to be present in a ratio of 15% than the copper, for later we are told that "this iron covers the most valuable ore, which is found by sinking through it. In

some parts of this iron there is much diorite and rhyolite," all of which suggests a geologic hash that can only be attributed to a volcanic cataclysm of a subversive kind. Moreover, it is a mineralogic melange, for "on the west side of the property the rock has undergone displacement, and is sprinkled with disconnected crystals of the ore, that is, copper, gold and silver". Then, at the conclusion of these delirious trimmings of geology, the scribe says something that is both true and well expressed: "Shifting minerals result in concentration, and where metallic minerals are concentrated ore deposits are formed." That is good. The processes by which minerals are segregated into masses rendering them exploitable at a profit, and thereby constituting orebodies, is a process of natural concentration, slow and patient, from a bygone geologic day to the moment when the miner's pick discloses it to human industry.

American Mining Congress

In the latest issue of the monthly 'Journal' published by the American Mining Congress we find the announcement of "a plan of enlargement" involving the creation of new departments for the systematic collection of statistical and industrial information. It is stated that "it is planned to still further add to the organization until it shall have one capable man at the head of a division devoted to each of the various branches of the mining industry, thus having what will in effect be several organizations, each with its division chief, all co-operating as one organization." In short, the Congress is to organize a Bureau of Mines. "This bureau," it is explained officially, "is undertaking to correlate the information gathered by the various governmental agencies, and to gather such additional information as will tie together and apply this information in a practical way to the basic principles of each branch of production." This last is more grandiose than explicit, but it suggests a comprehensive scheme. Finally we are told that "this bureau will be available to Members of Congress and others in position to use such information as a means through which to obtain absolutely reliable and complete information concerning every branch of the industry, and to see to it that governmental investigations shall carry the practical features which will make them of the greatest service, not only to legislators in framing laws to meet practical conditions but to operators in planning their operations so as to get the best possible results." This also is fine and large, but the question arises at once, what is the U. S. Bureau of Mines doing, if the Mining Congress feels impelled to organize a bureau to give more information and "apply it in a practical way". Has the U. S. Bureau of Mines failed to give "absolutely reliable and complete information concerning every branch of industry", meaning the mining industry, we presume, for the Mining Congress cannot possibly be planning to cover all industry in its purview. Have the "governmental investigations" failed to "carry the practical features which will make them of the greatest service" to legislators and mine operators? We think not. It looks to us as if we were going to see merely a further duplication of scientific and economic information, of which duplication there is already enough and to spare at Washington. One of the humors, if not scandals, of the war period was the way in which the Geological Survey, the Bureau of Mines, the Treasury, and the Department of Commerce collected data on identical subjects and worried mine operators with iterative questionnaires. What is needed today is closer co-operation between the various Federal departments, so as to save the taxpayer's money and systematize the vast collection of statistical and industrial information that is collected at Washington. We do not need any more multiplication of such agencies. It is wasteful and expensive. The Mining Congress proposes to defray the cost of its new departure by levying a contribution of 10 cents per 1000 dollars of production at the mines. If the mining companies choose to defray the expenses of the new bureau at Washington, it is their affair; but will it not be advisable to consider the demobilization of the technical gentlemen on the staff of the U. S. Bureau of Mines? The mention of the idea is enough to kill it. The U. S. Bureau of Mines, under Mr. Van H. Manning, is doing a splendid public service, conscientiously and successfully. We believe that Mr. J. F. Callbreath and his friends can do no better, if as well. Moreover, it is curious that the Mining Congress, to whose propagandism we owe the creation of the U. S. Bureau of Mines and the appointment of its first director, should now come out with a proposal to be a Bureau of Mines on its own account; it is killing its own child, which is considered bad form in polite society. Two pages of the 'Journal' are devoted to charts illustrating the intricate system of organization it is proposed to establish. On one we note the "Statistical, Administrative, Legislative Council", with lines leading to circles named 'Copper', 'Coal', 'Base Metals', 'Precious Metals and Rare Metals', 'Iron and Ferro-Alloy Metals', 'Non-Ferrous Minerals, Including Oil-Shale', and 'Petroleum'. These attach themselves to a 'Bureau of Mining Economics', to which is appended a 'Publicity Department', tied, in turn, to 'Lecture Bureau' and 'Press Service'. To us, this verges on absurdity, which is reached by the next chart, on which one big black balloon is attached to six baby balloons, named according to the gentlemen responsible for the several departments covering the proposed comprehensive activities of the Mining Congress. It is a foolish project. We say so without ill feeling, for we have supported the Congress in performing the work that was within its proper scope. This work has been done well by Mr. Callbreath, and the industry is grateful to him for what he has done; but the new departure is a blunder. We ventured to warn the Congress against such a step when it met in San Francisco last January. We said then: "If the Mining Congress should fail, it will be by branching out unduly and trespassing on the preserves of the official agencies. We believe that the Mining Congress has a useful function to perform on behalf of the mining industry, and we trust that it will not endanger its effectiveness by undertaking

to do too much." That is exactly what it is now doing. Let it stick to its proper function; that function is to serve as a permanent lobby at Washington in behalf of the mining industry. If it engages in the multitudinous activities now planned it will bankrupt itself in funds and in character. Mr. Callbreath had better "stick to his knittin' ".

Mr. Gompers and Strikes

One of the regrettable developments of labor aggression and capitalistic reaction is the driving of moderate men into the camps of the extremists. That is regrettable because unless a few forceful men remain moderate and judicial there will be increased difficulty in adjusting the problems of the hour. For example, Mr. Samuel Gompers appears to have lost much of his usefulness as a leader of labor by having been driven by the extremists among his own followers, and later by the uncompromising attitude of sundry exponents of capitalism, into alignment with the radical and subversive elements. During the War he behaved splendidly; his loyalty to the Government and to the cause to which the United States was committed, his thorough rejection of the German propaganda and his outspoken detestation of the crimes perpetrated by Germany, were greatly helpful to our winning of the War because they brought the ranks of labor into line with the national effort. He even did so worthily as to be attacked by 'The Nation', a distinction of which any good American may be proud. Since then he has been harassed by the more violent among his followers. He allowed himself to be driven into making the unpardonable blunder of supporting the striking policemen at Boston. This was a fatal error on the part of the head of the American Federation of Labor, for it indicates a lack of sound civic principle. Since then he has become party to a statement justifying the coal strike and condemning the injunction proceedings of the Government. The misunderstanding in regard to the promises made by Federal officials concerning the incidence of the Lever Act gives some excuse for his disappointment, even for his bitterness, but for the breaking of the contract between the coal-miners and the operators, Mr. Gompers can offer no excuse that will go down with the public. Such breaches of faith cannot be tolerated in a highly organized society; they entail irretrievable confusion, as well as wrong. This country fought to save democracy, but it is quite certain that the democratic system of living will be destroyed if public contracts are broken at the will of a mob or at the behest of a syndicate; it does not matter which. For that reason we would like to see the President reply fully, justifying his action in using the Lever Act against the coal-strikers. We believe that he can justify it and that the statements made by Mr. Gompers do not cover the facts fully. The President was warranted, it seems to us, in using any legal method helpful to the purpose in hand, namely, to prevent the country from being victimized by a general coal-strike. As Governor Coolidge has said, "There is no right to strike against the public safety by anybody, anywhere, at any time." "Safety" includes not only protection from disorder, but the assurance of continued food and transportation, the things essential to the life of the nation. Unless the Government can protect the people from social sabotage on the part of these warring industrial factions, it cannot be a government "for the people". When a quarrel between mine-owners and mine-workers reaches a point where the national welfare is imperiled, they must be made to stop, just as a quarrel between two individuals is stopped by the police when it interferes with the safety of their neighbors. Government exists for the purpose of keeping the peace; without it we go to the jungle or to the soviet. By the way, Governor Coolidge's given name, Calvin, smacks delightfully of Puritan New England. We like to see that tradition in the ascendant; let us have more of it, and less of the Sinn Fein and Jugo-Slav element in the political life of this country.

No improvement in the coal strike is visible, and contradictory statements are appearing from day to day in the newspapers. We note, however, that official statistics show a resumption of work equal to 50% of normal at the end of November, as against 29% in the first week and 33% in the second week of the strike. Mr. Garfield, the head of the Fuel Administration, has exhibited intelligence and sagacity in his efforts to settle the dispute and there is every reason to believe that his award of a 14% increase in wages is based upon a correct understanding of the facts. The one thing that does not seem to be sufficiently considered is the irregularity of employment and the large proportion of idleness characteristic of the coal miner's life. An average of $1550.58 per annum is high, compared with the salaries of teachers and professors, a class that should engage the interest and support of a democracy more than any other type of men, because upon education depends the very life of representative government. An average of $6.18 per day likewise is high, but it indicates an average loss of time amounting to 115 days per annum. Mr. Garfield is making an earnest effort to placate both the miners and the operators, and he has insisted repeatedly and most properly that no settlement can be considered that will increase the price of coal to the consumer. The public is awake to its interest in the matter, particularly as the drop in temperature and the fall of snow have brought home the fact that winter has arrived. Meanwhile Dr. Butler of Columbia, who never speaks publicly without saying something worth while, has suggested that it is futile to encourage a struggle of classes by regarding labor, capital, and the public as of equal importance in the social organization. Labor is a group of men working for wages, capital is a group of men employing labor, but both labor and capital constitute subordinate parts of the public. "The public is always everywhere their superior and includes them both." We venture to put it another way: Labor and capital are only parts of a complex social structure, and society as a whole must insist that both of them recognize their obligations to the body politic, under the laws of which, and for the welfare of which, they are supposed to operate.

Steel on the Pacific Coast

The Editor:

Sir—Under discussion, in your issue of November 15, Mr. R. C. Gosrow asks why steel cannot be made on the Pacific Coast by known and approved methods, by which, I take it, he means the reduction of ore in a blast-furnace and the subsequent conversion of the iron into steel in either open-hearth furnaces or Bessemer converters, according to the quality of steel desired.

The reason that this method cannot be applied on the Pacific Coast is that the bulk of the accessible ore on the Coast is magnetite, which cannot be reduced by ordinary blast-furnace practice without an addition of considerable quantities of more reducible iron ore, that is, ore that can be smelted at a lower temperature than is necessary for the reduction of magnetite. At any rate, so far as British Columbia and California are concerned, ore of the desired quality for this purpose has not been found in sufficient quantity in accessible situations, hence the metallurgist must have recourse either to the electric furnace, which gives a higher temperature, or to some untried modification of the blast-furnace that will bring about the same result. Hence, again, the necessity for experimentation. The electric furnace has been used in Sweden for about 20 years for the reduction of magnetite to pig-iron, but even so, it hardly can be said to have passed the experimental stage. A number of different types of furnace are employed and each type has its champions. Besides, conditions are not comparable; both labor and power are considerably cheaper there than here.

Thus, it seems to me, that we on the Pacific Coast, unless we can find a deposit of hematite, limonite, or other easily reducible ore, must work out our own iron problems to fit local conditions. Mr. Gosrow objects, too, to the attempts that are being made to make steel directly from iron ore in one operation. At first blush this may seem to be an ambitious undertaking, but it must be remembered that the control of both temperature and atmosphere (reducing, oxidizing, or inert) are infinitely greater in the electric furnace than in any form of combustion furnace, and by the careful use of this control I can see no good reason why a process should not be evolved for the production of steel directly from ore. If this can be accomplished at all, it is likely that it will be done at a considerably lighter fuel and labor expense than is necessary for the double operation, and, at the present time—irrespective of the immediate conditions brought about by the coal strike—fuel is as important a consideration as labor. The price of coal in Victoria, for example, has risen from the pre-war price of $6.50 to $11.50 per ton, which was the ruling figure before the coal strike in the United States.

The main thing in this research work is to see that public money is not wasted in fantastic experimentation. There are a number of people who always are willing to try to get something for nothing, people who are willing to spend state or provincial funds on researches on which they would not spend their own, and, unfortunately, there are those in authority who seem willing to provide such funds. The Province of British Columbia has been duped in this way on a number of occasions, notwithstanding that there are wise enough heads to keep it straight if those who have the spending of the money choose to seek and abide by such counsel.

Victoria, B. C., November 20. F. H. Mason.

The Salaries of Engineers

The Editor:

Sir—In your issue of October 18 I read with interest the communication from Mr. R. H. Toll on the subject of the small remuneration received by the technically trained man for his services.

I would venture an opinion that labor, mental and physical, is a commodity and therefore subject to the law of supply and demand. We witnessed the difficulty of maintaining an arbitrary price on copper in defiance of this law. The labor-unions claim credit for higher wages and better conditions for their members. Within certain limits arbitrary wage-fixing may be effective, but in the long run economic conditions determine the wage of the worker, based on the demand for his services. The lower limit of wages is that below which subsistence and support of a family are impossible and the upper limit that which makes the industry unprofitable. The nearer these limits come together the less effective unionism becomes in securing better conditions. It appears that this is the case now; the solution lies in eliminating waste and increasing efficiency, doing away with profiteering and repairing the wastes of war.

The point I want to make is that the engineer and brain-worker is poorly paid because the supply exceeds the demand. There exists in industry a limited demand for a certain percentage of brain-labor; the larger demand is for manual labor, skilled and unskilled. The young engineer and brain-workers in general accept this condition, because their road is the quickest way to the top of the ladder (perhaps only in their own minds).

It does not discourage young men from taking a technical training at college for this reason. Unfortunately the millenium has not yet arrived and the products of our mines, farms, and forests are won mainly by brawn.

Alice Arm, B. C., October 31. HEWITT O. FEARN.

The Editor:

Sir—I would like to add a few words to Mr. W. F. Dietrich's discussion, in your issue of November 8, especially since he has brought up the question of salaries paid to engineers and oil geologists.

In the Tampico oilfields, whence I have just returned, the oil companies are taking on young geologists at salaries ranging from $250 to $350 U. S. currency per month and all expenses, whether they are in town or in the field. The greater number of these men are still either sophomores or juniors in college. I do not think that these geologists are over-paid, for their work in that country entitles them to high salaries, but I do wish to point out that American surveyors, working side by side with these men and undergoing as great dangers and difficulties are in most cases drawing only $175 to $200 per month and expenses. These engineers are all *graduates* of good engineering schools and have had at least from one to three years experience in their profession. Can any one tell why there is such a large difference between the salary of an experienced man and an inexperienced one? After spending four years in an engineering college, the young engineer's investment should at least command the same salary as the young geologist, since they work together and are therefore indispensable to each other.

EDWARD D. LYNTON.

Los Angeles, November 15.

Mine Accidents

The Editor:

Sir—I would like to add a few remarks to the article written by Albert H. Fay in your issue of November 8, 1919, on 'Mine Accidents: English-Speaking v. Non-English Speaking Employees'. As we all know throughout this great country of ours, we have more men of different nationalities working underground than any one nation in the world, and these men as a rule, outside the English-speaking people, are incompetent miners or muckers; of course, you will find some exceptions among the non-English speaking people. The reason for this incompetency is that they have never had experience in underground work, only farming and outside work. With all my experience of mining in America and England I find most of the accidents are due to carelessness of these men, making conditions very unsafe for all concerned. As a general rule in England the miners must talk the English language, which I think is as it ought to be. We have here so many different nationalities to contend with that this method is hardly practicable at present. I recall an incident at Livingston, Montana. We were driving a tunnel, two side-drifts and a heading, using crown-bars in the centre, working eight men in the heading (hand work), four in the face and two on each side. The ground being very heavy, it had to be watched closely; at this time the ground was taking weight and the crown-bars were cracking. The men were ready to run and jump off the bench, about 15 ft. high, which no doubt would have meant injury to all. I backed them all to the face of heading, and myself and another man braced up the crown-bars and timbers safely under dangerous conditions, thus avoiding a serious accident, and when I told the men to resume work they said, "You good boss, me jump, me hurt," and that little happening made these men 100% better miners.

Here in Grass Valley we have very competent miners, and the one thing that makes the miners careful is the Safety Bear club we organized several months ago, holding meetings twice a month. The subjects of discussion are the ways and means of avoiding accidents, methods for 'safety first', and 'first aid' work, all of which are interesting, and the men all take it seriously. We also have a safety committee, which inspects the company's two mines, and they report each month the places that are not safe, and then officials see that these places are fixed and placed in good condition. The company spares no expense whatever in rectifying these things for the safety of their employees, and through the 'safety first' methods we have derived a great benefit; less accidents, better conditions, and all methods of safety practice underground and on the surface, and we are still trying to better 'safety first' methods wherever it is needed, for the benefit of all.

HARRY S. CORDELL.

Grass Valley, California, November 8.

[We are glad to publish this letter, but we demur to the sweeping generalization made by our correspondent, for he knows, as we do, that many of those not speaking English are excellent miners, particularly the Piedmontese.—EDITOR.]

WITH the cession of Alsace-Lorraine to France, Germany loses the rich potash deposits of Alsace, and with them the potash monopoly of the world, according to the 'Vossische Zeitung'. The potash deposits extend 16 kilometres (9.9 miles) to the north of Mühlhausen, over a surface of more than 180 square kilometres (69 square miles). They are unusually rich in potash salts, much richer in fact than the beds in the interior of Germany. They are, moreover, easier to exploit. Their thickness ranges from 3.7 to 5.4 metres (12.1 to 17.7 feet). The thickness of the smaller beds in the upper layers varies from 0.8 to 1.5 metres (2.6 to 4.9 feet). The first workings were begun in 1909; in 1913 there were 12 in operation. In a period of only three years the production rose from 42,420 to 287,000 metric tons, so that the production of potash in Alsace in 1913 was already one-fifth of the entire German output. The total capital invested in the potash works of Alsace amounted to 34,400,000 marks ($8,187,200 at normal exchange). The production of these workings, it is calculated, would supply the world's requirements of potash for 250 years.

Technical Operations on the Suan Concession, Korea—III

Design and Equipment of the Tul Mi Chung Mill.

By A. R. WEIGALL and J. F. MITCHELL-ROBERTS

GENERAL.—There are two mills on the Concession; one at the Suan mine and the other at Tul Mi Chung.

The Suan mill consists primarily of a stamp-milling and table-concentration plant with an accessory flotation equipment of later date. The first section of this mill, consisting of 20 stamps, was erected in 1909. In the following year 20 stamps were added, and in 1913 flotation was introduced. The mill has a capacity of about 8000 tons of ore per month.

The Tul Mi Chung mill was erected in 1915. In this plant Hardinge mills were employed in place of stamps and the mill is primarily designed for flotation concentration. Accessory amalgamation was included in the flow-sheet but, after eighteen months' trial, was eliminated. The product of this mill consists principally of flotation concentrate with small amounts of table-concentrate from concentrating tables added at a later date. The mill has a capacity of about 14,000 tons per month.

When the Suan mill was designed, the main object was the saving of the gold in the ore. At that time the small amount of copper present, averaging about 1%, was thought to be too low to form an asset of any importance and the presence of 0.1% of bismuth was not taken into account at all. In this mill amalgamation was expected to save the gold and the table-concentration plant was added with the object of saving as much as possible of the gold that was not caught by amalgamation in the form of a gold-silver-copper concentrate, which was shipped to a smelter. After the mill had been in operation for some time the presence of appreciable amounts of bismuth in the top streak on the concentrating tables was noticed and this portion of the concentrate was saved as a separate product. Up to 1913, when flotation was introduced, the average percentage of recovery in this plant was gold 84%, of which 75% was saved by amalgamation, copper 29%, and bismuth 26%. The small amount of silver in the ore, about half an ounce per ton, was not included in the mill figures. After the introduction of flotation in 1913 the gold and copper extractions were increased to slightly over 90% and the bismuth extraction increased to about 60%. The small amount of bismuth and silver in the ore does not warrant daily determinations of the amounts of these metals in the crude ore, and only approximate figures are available. On an ore of this character the above gold and copper extractions are regarded as being satisfactory, more especially as high transportation charges and the requirements of the smelting plant to which the concentrate is shipped call for a grade of concentrate of 25% copper or more, and the average grade produced is about 26% of copper.

The average grade of the Suan mill ore to the end of 1918 was gold $8.75 per ton, silver 0.6 oz. per ton, copper 0.92%, and bismuth 0.08%.

The Tul Mi Chung mill-ore to the end of 1918 has had an average grade of gold $6.12 per ton, silver 0.5 oz. per ton, and 0.98% of copper. The main product of this mill is in the form of a flotation concentrate containing gold $100 per ton, copper 26%, and 9 oz. silver per ton. About 4% of the total mill production is saved in the form of a table-concentrate containing gold $45 per ton, silver 2 oz. per ton, and 1.5% copper. In this mill the copper extraction is high especially in view of the high grade of concentrate produced, and during 1918 averaged 90.34%. The gold extraction is unsatisfactory, averaging 60%, the figure for 1918 being 58.72%. The tailing is being saved for re-treatment and, as will be seen hereafter, the problem of obtaining a satisfactory gold extraction from this extremely refractory and difficult ore is one that has been the cause of a great deal of experimental work at the mine, in America, and in England. The final decision, after investigating every possible alternative method of treatment, is to increase the table-concentrating equipment by means of which it is expected that the gold extraction can be improved by about 10% and the cyanicides in the tailing will be cut down, and then treat the accumulated and current mill-tailing by simple leaching with cyanide, by which it is expected to recover 70% of the gold in the tailing. The purchase of this cyanide plant, which will have a capacity of 600 tons of tailing per 24 hours, has been delayed owing to the high cost of all machinery and plant and the abnormally high freight-rates.

AT TUL MI CHUNG.—This mill is situated 3300 ft. from the portal of the main adit. The connecting double track, which is of 2-ft. gauge, is laid practically level, there being only a fall of slightly over 3 ft. in the total length. Two-ton (36 cu. ft. capacity) U-shaped cars are in use, two of which form a train and are drawn by a mule.

The design of the mill was based on the test results of samples of ore taken from the developed orebodies, which at that time amounted to approximately 350,000 tons. The following analysis will give a good idea of the class of ore tested:

	%
Insoluble	57.17
Silica, soluble	0.07
Iron	4.90
Alumina	9.15

	%
[illegible]	1.78
[illegible]	[illegible]
[illegible]	4.40
[illegible]	10.16
Sulphur	[illegible]
[illegible]	0.1
[illegible]	4.83
	100.0

A further analysis of the residues show their composition to be:

	%
[illegible]	57.81
[illegible]	[illegible]
[illegible]	5.59
CaO ..	[illegible]
MgO ..	2.89
[illegible]	1.00
	67.17

As the preliminary tests brought out the paramount importance of fine grinding owing to the ore-minerals being in an abnormally fine state of division. Water-concentration did not yield a satisfactory result, owing to the fact that unless all the ore was ground finer than 100-mesh (Tyler standard) the middling product still contained the bulk of the valuable contents. Owing to the distance of the mines from the railroad, it was essential to produce a high-grade concentrate, and flotation presented the easiest method of recovery of the very fine mineral.

Although about 70% of the gold was recovered in the tests by flotation, amalgamation prior to flotation did not appreciably increase the recovery. Cyanidation after flotation, however, showed that part of the gold unrecoverable by flotation or amalgamation could be saved.

It being considered injudicious to proceed with the design of a cyanide plant to treat the tailing before the exact results of milling were known, it was decided that amalgamation plates could be added at a slight extra cost. The mill therefore was designed for fine crushing, amalgamation, and oil-flotation, with an estimated capacity of 300 tons per day. It consisted of

1. Grizzlies, 4 by 10 ft., bars spaced 3 inches.
2. Primary crusher, 30 by 18 in., set to 3 inches.
3. Revolving screen, 16 by 4 ft., having perforated plates with 1½-in. holes to pass 1-in. cubes, and a section with ¾-in. holes fitted with a water-spray to remove adhering dirt prior to hand-picking.
4. Undersize to 7, by 24-in. belt-conveyor.
5. Picking-belt, 36 in. by 60 ft., for removal of waste.
6. Two secondary crushers, 20 in. by 6 in., set to crush to 1 in.
7. Belt-conveyor, 24 in. by 106 ft., over ore-bins.
8. Hand propelled tripper.
9. Ore-bins of 1600 tons capacity.
10. Three 24-in. adjustable belt-feeders.
11. Three Hardinge conical ball-mills, 6 ft. by 16 in.
12. Three Dorr duplex type C classifiers.
13. Undersize to 16 by launders.
14. Oversize to 15 by screw conveyor.
15. Three Hardinge pebble-mills, 8 ft. by 36 in.
16. Three Dorr duplex type C classifiers.
17. Undersize to 19 by launders.
18. Oversize to 14 (15 by screw conveyors).
19. Three four-way cast-iron pulp-distributers.
20. 12 amalgamation plates, 4 ft. by 12 ft., slope 1¾ in. per ft.
21. 12 Pierce amalgam traps.
22. Three Kyloe type thickening-tanks, overflow to waste, underflow to 23.
23. Primary M. S. type flotation machine, having 8 boxes 29½ in. by 29½ in., concentrate to 24, tailing to waste.
24. Secondary M. S. type flotation machine, having 8 boxes 16 in. by 16 in., concentrate to dewatering plant, by 25, tailing to 25 by 26.
25. Frenier pump, 54 in. by 10 in.
26. Frenier pump, 54 in. by 10 in.
27. Concentrate drying plant.

The original tests had shown the possibility of producing a 15% copper concentrate with a resultant 0.18% copper tailing. Soon, however, after the plant was in operation, the grade of concentrate was increased to 25% with ease and an equally good tailing resulted.

The amalgamation proved that it could not equal the test results and only about 50% of the amalgamation shown possible by the tests was obtainable. Furthermore the arsenic in the ore had appreciably increased, making amalgamation difficult and practically useless.

As indicating the change that has taken place in the ore since the sample was taken for the tests upon which the mill was designed, the following analysis, which is a composite of the ore treated in the month of September 1918, is interesting.

	%
[illegible]	67.07
[illegible]	7.45
[illegible]	0.69
Copper	1.18
Lime	10.76
[illegible]	1.43
[illegible]	1.76
Bismuth	0.11
[illegible]	0.05
[illegible]	0.37
Zinc	0.30

The arsenic content was originally about 0.12%, whereas now it has increased to an average of 0.36%. This change in the composition of the ore has been accompanied by a change in the association of the gold. Formerly the gold was much more closely associated with the copper minerals (mainly chalcopyrite), which were recoverable by flotation, than with the arsenical minerals, which are not recovered to any great extent by flotation, but with the increase in the amount of arsenic the tendency has been to diminish the association of the gold with the copper minerals and to increase the association of the gold with the arsenical mineral (lollingite) in the ore. This feature has had a marked effect in increasing the metallurgical difficulty of obtaining a high gold recovery, the difficulty being increased by the abnormally fine state of division in which the lollingite occurs.

The ore has contained a fairly constant amount of oxidized copper minerals, averaging 0.03% of copper.

The presence of slime in the pulp was found to hinder the oiling of the sulphide minerals, and tests were carried out with a view to lessening this tendency. After many tests and trials, the addition of caustic soda at the ball-mills was found to improve the recovery. Subsequent tests further showed that the addition of flotation-oils at the ball-mill feed recovered more copper and gold. At this time amalgamation was discarded, and, with a view to putting in concentration tables after flotation

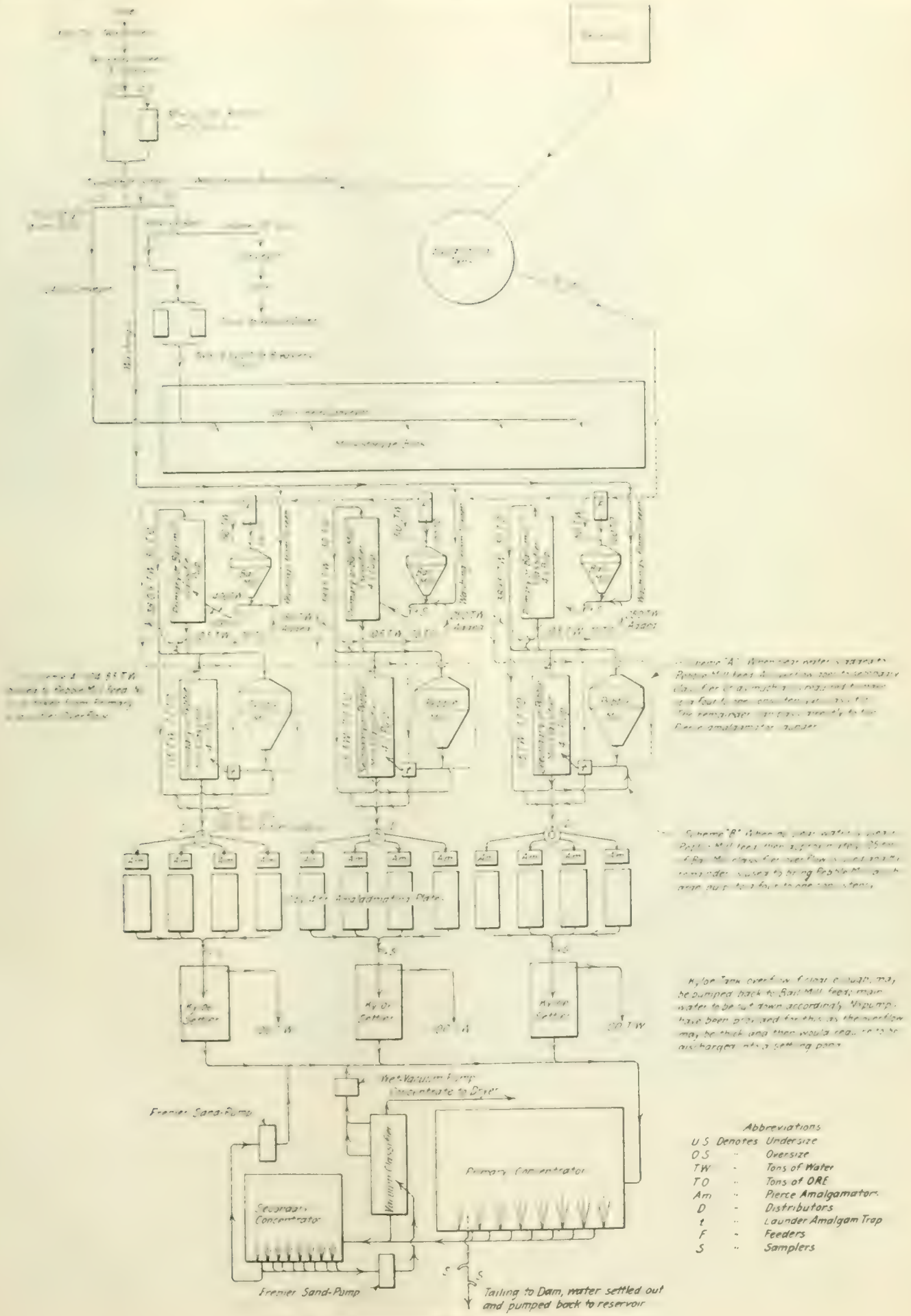


FIG. 4. FLOW-SHEET OF THE TUL MI CHUNG MILL

for the recovery of the arsenic gold minerals, the amalgamation floor was dismantled and the flotation machines moved up.

After this had been completed, four large Deister roughing-tables were added to treat the flotation tailing. The operation of the flotation plant was also modified as follows: On the primary machine the concentrate from the first five boxes only was sent to the secondary machine, the froth from the remaining three boxes being returned to the primary feed along with the tailing from the secondary machine. The concentrate from the first four boxes of the secondary machine was finished clean concentrate and the concentrate from the remaining four boxes was returned to the secondary feed. To effect a further saving of mineral, all of the tailing from the tables was run over a canvas plant consisting of seven strakes each 7 ft. wide and 40 ft. long. The concentrate from this plant was re-cleaned on the tables in order to enrich the product to an economic shipping grade having a gross value of $60 or more per ton.

Subsequently this plant was re-modeled and moved closer to the mill. The new plant consisted of twelve cement strakes each 4 ft. wide and 50 ft. long having a slope of 1¾ in. per foot.

Crushing. The primary crusher and the revolving screen are driven by a 60-hp. motor. The secondary crushers, undersize belt-conveyor, picking and distributing belt over the ore-bins are also driven by a 60-hp. motor.

The estimated capacity of the crushing plant was 40 tons to 1-in. ring per hour. In practice, with one of the secondary crushers only running, the average is 30 tons per hour; and with both crushers running, 60 tons per hour. At times, for short periods on dry free-crushing ore, as high as 90 tons per hour has been accomplished.

At the commencement of operations in this mill the ore immediately gave indications of being troublesome, both from a mechanical and a metallurgical standpoint. As delivered to the mill the ore contains, and specially during the wet season, considerable amounts of the most sticky clay it is possible to imagine. At the same time some of the ore is of abnormal hardness and toughness, from the presence of lime-garnet and tremolite in the gangue, the crushing of which, especially when in large blocks, throws heavy strains on the crushers. The mechanical difficulties in handling an ore of this type can readily be imagined, and special provision had to be made to prevent the clay masses from choking the crushers and chutes. So unctuous was this clay that if it was thrown against the roof it adhered. This difficulty with clay was mainly overcome underground, by preventing as much water as possible from entering the chutes, and by arranging to send to the mill alternate cars of wet and dry clean ore, which cut out the clay accretions on the crusher-jaws.

Owing to the excessive hardness and toughness of the ore, the swing-jaw of the primary crusher, without warning, snapped in two early in January 1917, after it had been in service only 14 months. The break was clean, the fractures showing no signs of flaws or blow-holes. This casting was too large for the mine foundry and the delay in sending it to the nearest foundry capable of making a casting of this size would have seriously reduced the output of the mill. After discussing various alternatives, the master mechanic, C. S. Crowe, undertook to build a temporary jaw of ½-in. steel plates with oak-packing between. This jaw was built and in operation one week later. So satisfactory has this jaw proved in operation that after two years of steady and satisfactory service it remains in excellent condition, having in this period crushed over 300,000 tons of ore. Subsequently similar breakages took place in the secondary crushers, and similar built-up jaws have been made to replace the former cast-iron jaws. They are giving such satisfaction that the use of further cast-iron jaws has been abandoned. The jaws cast locally for the secondary crushers have only lasted two months. See. Fig. 1 and 2.

Special mention has been made of this matter, as it may be found of use in the case of other mills similarly situated far away from foundry facilities, and as the jaws can be made in a small machine-shop and the materials entering into their construction are such as are usually stocked at any mine.

Sorting. Originally it was thought that about 15% of the barren waste could be hand-picked from the ore, and for this purpose a washing compartment was provided in the revolving screen ahead of the picking-belt. However, contrary to expectations, the amount of waste that could be hand-sorted has never exceeded 2% and consequently water is not now used on the screen, which serves only to separate the minus 1-in. material.

The discarded waste contains little value; it averages gold 50c. per ton and a bare trace of copper. It consists principally of clean limestone. On the other hand, the picking-belt is useful in enabling tramp iron, steel, and wood, as well as Korean straw shoes, to be removed from the ore before entering the secondary crushers.

Grinding. This part of the plant is arranged in three units, each of which is equipped as follows:

24-in adjustable belt-feeder;
Hardinge ball-mill, 6 ft. by 16 in.;
Dorr duplex type C classifier;
9-in. cast-iron spiral conveyor;
Hardinge pebble-mill, 8 ft. by 36 in.;
Dorr Duplex type C classifier.

One general account will serve to describe the whole plant, as the units are similar and interchangeable in all details.

The feeders, which are of special design for a quick change of capacity without necessitating stopping, are fed from the 1600-ton ore-bin by means of a rack-and-pinion gate 18-in. by 24-in. The three feeders are operated from a common line-shaft driven by a 5-hp. back-geared motor. Special mention is made of this feeder as it has proved highly efficient under a great variety of conditions, from perfectly dry free-running ore to the most unctuous sticky variety. These feeders have been

in continuous operation for the past three and a half years, during which time they have handled over 450,000 tons of ore with practically no repairs. Each belt will last for over 100,000 tons of ore. See Fig 3

The feed falls directly into the feed-box of the Hardinge ball-mill along with the requisite amounts of water, caustic-soda solution, and eucalyptus oil. Head samples are taken at the feeder discharge over a period of 15 seconds every hour, and, after drying, the average weight of these samples is used to calculate the amount of ore treated per day. The figure obtained closely checks the actual weight of ore delivered to the mills as recorded at the weigh-bridge at the head of the plant. Usually the difference is less than 0.25% per month.

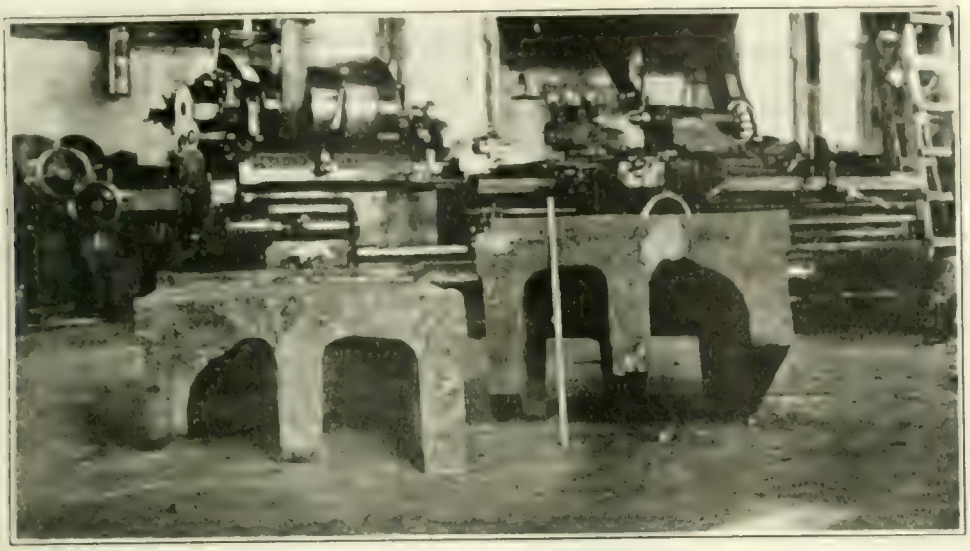


FIG. 1. THE BROKEN CRUSHER-JAW

To test this point an investigation has recently been made covering the last 12 months. The result showed that on a quantity of 151,129 tons as given by the weight of ore delivered to the mill less the weight of the discarded waste, and moisture deduction, the feeder-weights checked with the delivery figure within a difference of 251 tons. Other monthly tests have confirmed the accuracy of an hourly 15-second feed sample taken at each mill-feeder. Each shift-sample so obtained is subsequently used to determine the average grade of the ore milled.

The final average grade of the ore milled is determined by the value contained in the products plus the value discharged in the tailing. A close agreement is obtained with the estimated grade of ore milled. For instance, in the previously mentioned investigation covering a period of one year, the following figures were obtained for the average ore milled:

	Gold per ton	Copper %
Head value of ore	$6.53	0.89
By assay of ball-mill feed	6.45	0.87
By products plus tailing		

The ball-mills are provided with single scoops of the usual type with renewable cast-steel tips of a serrated pattern. The linings are of cast-chrome steel and five-inch forged chrome-steel balls are used. The life of the linings is good for 30,000 tons, and then only the feed end and cylindrical belt-linings require renewals, the remainder of the linings being good for 50,000 to 60,000 tons. The wear of liners per ton of ore milled amounts to an average of 0.208 lb. and the steel ball consumption averages 0.47 lb. per ton milled. Each mill carries a charge of 10,000 lb. of balls, additions being made daily.

Each mill is direct driven by a 60-hp. 432 r.p.m. motor, through a flexible coupling and eight-inch face double-helical cut-gear 2¼-in. diametrical pitch. The gears are whole, and of cast-iron; the pinions are cut from the solid shaft. The motors are mounted on an extension of the discharge-end base-plate, making the whole arrangement solid and secure. The motor-frames are of the ordinary 120-hp. size and heavily wound to withstand the excess starting torque required by the mills.

FIG. 2. AN EXTEMPORIZED CRUSHER-JAW

The discharge cone is provided with a half-inch aperture heavy-wire cylindrical screen, which delivers any oversize discharged from the ball-mills directly into the feed-box of the succeeding pebble-mill. The undersize product from the screen, with additional water,

Typical Screen Analyses

	Ball-Mill			Classifier overflow	Pebble-Mill discharge	Secondary oversize	Concentrate
Mesh	inch						
18							
14		0.1	1.1				
20			0.3				
28							
35		0.1	0.9				
48		0.1					
65		0.1					
100		0.1					
150		0.8	9.5			1.0	
200		0.8	13.5		0.3	3.8	
270		0.6			0.7	8.3	
325		0.7	13.5	1.1	13.4	17.9	0.1
400		0.6	6.8	6.3	23.5	33.7	8.8
500		0.6	3.8	7.6	18.7	17.9	20.0
600		0.6	6.8	7.6	9.9	7.4	18.4
Slime		2.0	19.1	73.0	75.0	10.3	99.0

flows to the primary classifier. The overflow product from this classifier is 100-mesh and is laundered to the discharge of the pebble-mill (see flow-sheet Fig. 4).

The oversize product of the primary classifier along with the oversize from the closed secondary classifier circuit is delivered by means of a nine-inch diameter spiral conveyor to the feed-box of the pebble-mill. This conveyor is driven by a No. 78 chain from an extension of the primary-classifier driving-shaft. The renewable interlocking flights for these conveyors are cast at the [illegible] and last from 30 to 40 days.

The pebble-mills are driven in a similar manner to the ball-mills. These mills were originally lined with chert, owing to the fact that, at the time the mill was erected, silex was unobtainable, the source of supply at Mons being cut off. Further supplies of chert not being obtainable, owing to the great increase in the freight rates to the Orient, a local substitute in the form of blocks of extremely hard ore from the Suan mine was employed. Subsequently, on the depletion of this source of supply, hard dolerite, which occurs in the vicinity, was found not only a cheap but an excellent substitute.

After considerable experimenting with various forms of lining, the dolerite with interspersed cast-iron lifting-bars, generally similar to those used at the Liberty Bell mill in Colorado, was adopted. These bars are spaced 12 inches on the cylindrical part of the walls and proportionally elsewhere. A spare shell is kept on hand. [illegible] as the crane capacity was designed to lift a silex-lined mill and is insufficient to lift a mill completely lined with seven-inch dolerite blocks and the cast-iron lifting-bars. A mill is replaced and in operation [illegible] 24 hours. The change and relining of half the mill consumes 12 hours. As soon as the mill is lined, live steam is turned into it and 12 hours later the mill is again in operation.

Formerly a supply of Danish pebbles was furnished, but as this supply being consumed, local pebbles obtained from the shores of the islands off the coast of Korea in the neighborhood of Chemulpo and Mokpo were used and recently when experiments with roughly rounded five-inch dolerite blocks were made, proving so satisfactory that they are being adopted.

The pebble consumption [illegible] with the use of pebbles obtainable. With Danish pebbles the consumption averaged about 2.5 lb. per ton of ore milled; whereas with Korean pebbles the consumption rose to 5 to 7 lb. per ton; but even with the increased consumption the Korean pebbles proved much cheaper than imported pebbles. Dolerite pebble consumption would appear to be about 4 to 6 lb. per ton of ore milled and will cost less than half the previous price of Korean pebbles. The fineness of the product has remained practically the same with all varieties of pebbles used.

With the object of lowering the power consumption of the pebble-mills, they are provided at the discharge-cone with a revolving slotted diaphragm, enabling the pebble load to be maintained well above the centre of the mill without 'belching out' the overload. The normal pebble load under these conditions is approximately 14,000 lb. as against 11,000 lb. for mills not so equipped. A newly lined mill requires about 55 hp. to operate it, and this consumption of power increases as the lining becomes worn until at the time of re-lining the power required is nearly 70 hp.

The discharge from the pebble-mill together with the overflow from the primary classifier, as well as some extra water, flows to the secondary classifier. The pulp consistence in this classifier is maintained at about 1 part ore to 2½ to 3 parts water, so that the final overflow varies between 1 part ore and 3 to 3½ parts water. At this consistence the pulp flows directly to the flotation plant.

Trouble was experienced owing to the presence of wood chips, etc., getting into the flotation machines. This difficulty was overcome by inserting a screen under the discharge of the secondary classifiers, in full view of the attendants.

The classification of this ore presents a difficult mechanical problem owing to the fact that some of the gangue is composed of garnet of high specific gravity and the remainder is composed of relatively light gangue-minerals. The difficulty is augmented by the presence of much colloidal gangue-slime. Unless the pulp dilution is maintained constant, the density of the pulp is insufficient to buoy over the minus 100-mesh garnet particles. On the other hand, should the density be too high then the coarse relatively lighter minerals flow over, giving an excess of oversize. To adjust these conditions to a nicety requires long practice and constant attention and even then marked changes in the character of the ore occur not only from day to day but from hour to hour, necessitating constant vigilance.

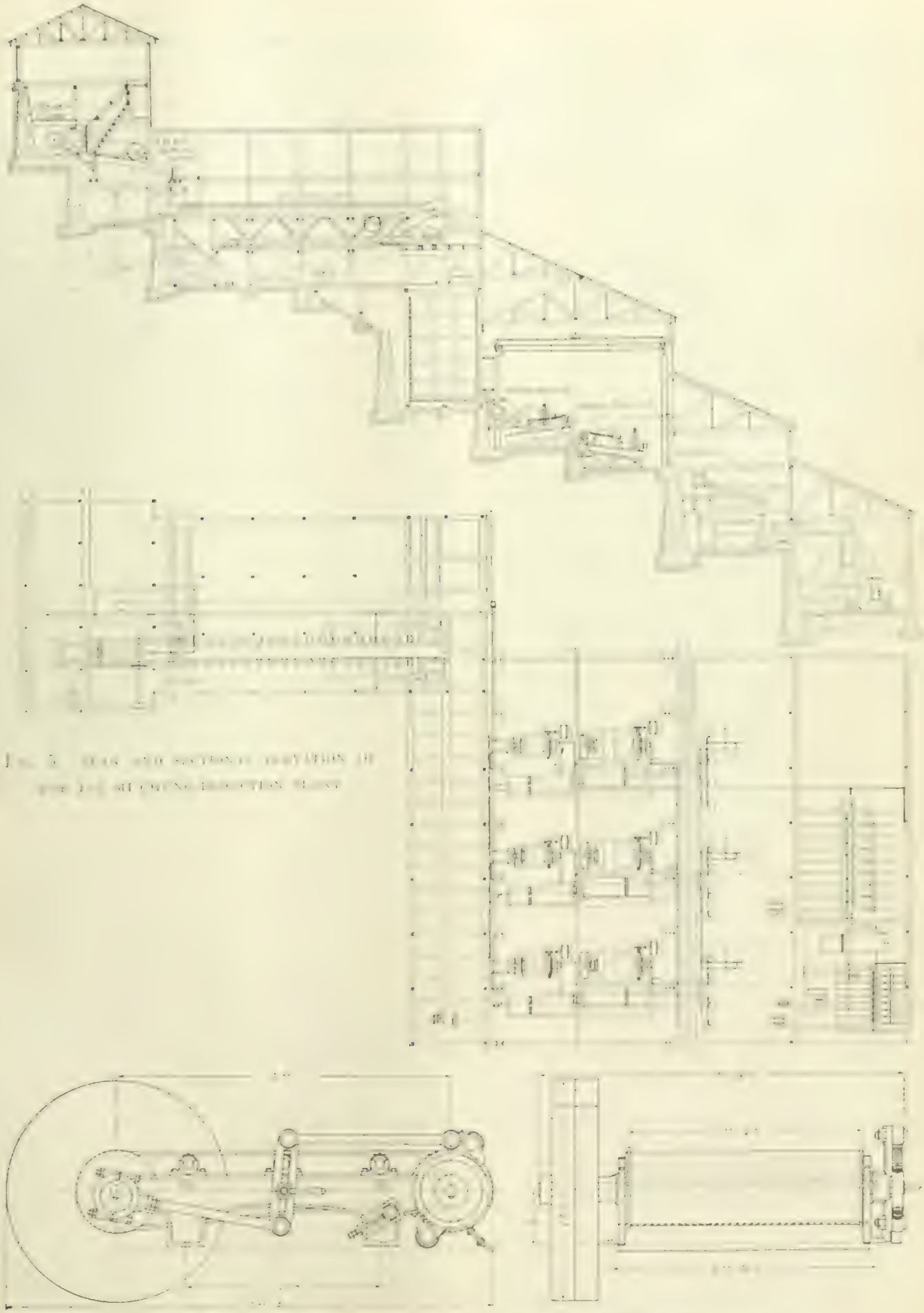


FIG. 3. GENERAL ARRANGEMENT OF BELT FEEDER AT THE TUL MI CHUNG MINE

In both ball and pebble mills the dilution is now maintained at approximately 33% of water.

As to fineness, the aim has been to reduce the ore so that the feed to the flotation plant does not contain more than 10% oversize on a 100-mesh screen. Further, the extraction varies almost directly with the percentage of 200 product in the pulp. In order to maintain a high grinding efficiency, hourly screen-samples are taken on each unit, and for these analyses the Rotap screen has proved itself invaluable.

The classifiers in the mill are operated from a common line-shaft driven by a 5-hp. 1190 r.p.m. motor.

No water-wash over the rakes is used in the classifiers, which accounts partly for the amount of minus 200-mesh material in the classifier returns. This material consists for the greater part of garnet, its presence there being due to its high specific gravity.

At the time the grinding scheme was designed little was known of the grinding qualities of the 8-ft. ball-mills, the only installation at that time being in Sweden and operating on iron ores. The experience since gained has shown that, when operating upon a hard and tough ore, the 6-ft. mill does not produce sufficient grinding effect unless the ore is crushed small. Better results would have been obtained by having the mill in one unit, using one 8-ft. ball-mill and two similar mills of the same size re-grinding with smaller balls. The power consumption would have been the same and the tonnage output would have been increased, or, with a reduced tonnage, grinding to a finer degree would have been practicable. The results are well illustrated by the work done in the new units in the Miami Copper Co.'s mill, in Arizona.

FLOTATION. The flotation plant comprises two machines of the M. S. type, each driven by separate motors. The primary machine is of eight boxes, 29½ in. square with eight spitzkastens. It is belt-driven by a 60-hp. motor. The illustration shows the original machine, to which subsequently another spitz-box was added in front of the first agitating-box. This change was made when the flotation oils and reagents were added at the ball-mills instead of adding them to the pulp as it entered the machine, after coming from the amalgamation plates.

The secondary machine is similar in all general details and has eight boxes each 16 in. square. It is belt driven by a 20-hp. motor. It serves to clean the primary froth-concentrate.

These machines were among the first to be driven by gearing, and, in order to safeguard the continuity of operation, phosphor-bronze gears (20 and 19 teeth) were provided. In practice these gears are run in a medium heavy grease and have proved eminently satisfactory, operating almost noiselessly. After four years of constant service they show practically no sign of wear. The use of phosphor-bronze gearing is to be strongly recommended.

Among other features of more than general interest may be mentioned the use throughout of ball-bearings. The main driving-shaft is in sections, each section driving two impeller-shafts. These individual sections of shafting are connected by means of concentric couplings, which allow any particular section of the shaft to be removed without disturbing the remainder. This detail is a great convenience.

The flotation machines, as stated above, being the earliest gear-driven machines made, full advantage was not taken in their design of the method of absorbing the end-thrust by having adjacent spindles revolve in opposite directions, consequently a thrust-ring (ball) is employed on the end bearing. Drawing of the flotation-machine will accompany the description of the flotation plant in the Suan mill, to be described in the next article.

The primary machine was designed for a capacity of 250 to 400 tons per day; but with the fixed pulp dilution of 3:1, or 3½:1, no difficulty is experienced in handling 600 tons of ore per day. The only modification made as the tonnage increased was to enlarge the pulp-passes between the agitating and spitz-boxes to 20 by 2 in., which opening is satisfactory. Cast-iron lips are used to protect the edges of these apertures.

Formerly the agitating-boxes were wood-lined, but later cast-iron liners have been used. They give a minimum of trouble.

The agitating spindles revolve at a speed of 300 r.p.m. and are provided with impellers 21 by 3 inches.

For the removal of froth, the usual revolving paddles are employed.

After considerable experimentation the machine is now operated as follows: Boxes No. 1 to No. 5 produce froth for the secondary re-cleaning machine, to which machine it is sent by a centrifugal pump (Krogh 2-in. slime-pump). The remaining three boxes are run with a rapid overflow, to ensure the removal of all the froth produced. This product is pumped back to the primary feed by another centrifugal pump for further agitation. The primary machine also receives the return tailing from the secondary re-cleaning machine.

Assays of Froths

	—Primary Machine—		—Secondary Machine—	
	Gold	Copper	Gold	Copper
Box No	dwt. per ton	%	dwt. per ton	%
1	61.40	23.00	64.00	28.40
2	75.40	19.70	71.20	24.80
3	86.80	15.20	75.20	20.60
4	86.80	12.00	73.60	18.50
5	74.80	10.80	61.20	15.80
6	10.10	2.00	44.40	10.90
7	11.60	1.10	53.00	9.60
8	15.80	1.50	....	....

To provide against flooding and choking caused by the sudden stoppage of power, an emergency launder is provided by means of which the flotation machine can be immediately short-circuited and emptied into a sump. The secondary machine is used solely for re-cleaning and enriching the grade of concentrate produced by the primary machine.

In current practice boxes No. 1 to No. 4 are operated to produce a finished clean concentrate; boxes No. 5 to No. 8 produce a concentrate that is fed back to the first box. The last four boxes are only overflowed at a moderate rate, as the tailing from this machine is returned to the primary machine for further treatment. The capacity of this machine is from 50 to 75 tons per day; it seldom receives more than 40 tons per day of primary

concentrate. No additional oils or reagents are added to the secondary machine. The effect of the addition of various reagents and oils has been tried, but without beneficial results.

The final concentrate is laundered with additional water to a Dorr thickening-tank 30 ft. diam. by 10 ft. deep. The overflow water from this tank is piped back to the pump elevating the primary concentrate to the secondary machine and serves to equalize the feed and volume of the circuit.

The thickening-tank is provided with a sheet-steel annular baffle of 6 ft. diam. by 3 ft. deep, suspended so that it is 27 in. under the surface of the water. This baffle surrounds the central axis of the tank and the concentrate is laundered so as to fall almost in the centre of the baffle. A fine jet of water at high pressure is allowed to play on the concentrate as it touches the surface of the water in the tank. This method of breaking down the froth is very satisfactory; it is probably assisted by the presence of caustic soda in the mill-water. The overflowing water carries little, if any, suspended mineral, and should at any time froth break away and overflow, it is again caught in the flotation circuit.

The thickened concentrate contains about 30 to 35% of moisture and is withdrawn periodically from the bottom of the tank through a 1½-inch plug-cock into 1 ton (20 cu. ft.) U-shaped water-tight cars and trammed to the drying-house by hand.

TABLES. The primary flotation tailing runs to a four-way distributor and is laundered thence to four large Deister roughing tables. Each of these tables handles from 100 to 125 tons of tailing per 24 hours. To prevent a heavy cross-flow of the pulp when handling this tonnage, every sixth riffle is doubled in height up to the cleaning plateau, and by this means a satisfactory segregation of mineral particles is possible.

The primary object of the tables is to recover the iron-arsenic-gold minerals, which are only slightly susceptible to flotation, and to act as a safeguard against loss of copper mineral that may have escaped flotation. Naturally, the product of the tables varies considerably with the grade of ore being milled. Free gold, which is rare, is saved on the tables along with the arsenical minerals.

The average value of the table-product is about $60 gold per ton and 3 oz. silver with 1.5% of copper and 8% arsenic. However, at times, the grade has increased to $150 gold per ton, the other constituents remaining practically the same. A separate sample of the lollingite streak on the tables always runs high in gold, and samples taken have shown $1800 per ton without visible gold being seen, even under high magnification. The arsenical minerals invariably occur in an extremely fine state of division and all will readily pass a 200-mesh screen. The abnormal fineness of these minerals and their high gold-content constitutes one of the main difficulties in securing a good extraction of the gold. To completely free all arsenical minerals from the gangue, it would appear necessary to grind to a fineness that is not economically practicable.

With a view to possible subsequent cyanidation of the mill-tailing, it has always been the practice, in operating the table plant, to remove as much as possible any cyanicides in the ore.

Table concentration on the fine product separates out all the abraided iron from the ball-mill grinding. The ore contains also a considerable amount of magnetite, which still further dilutes the concentrate. As much as 33% of the table-concentrate is made up of magnetic particles carrying low gold-values, to remove which a new system of magnetic concentration is being tested. Another diluent of the concentrate is the iron-lime garnet constituent of the gangue, which is invariably present in excess of 15%. The high specific gravity of this mineral tends to throw it well up into the other mineral streaks on the concentrate end of the table and it can only be cut out at the expense of sending a considerable amount of the other minerals into the tailing. At one time it was thought that by cutting out this garnet streak separately and cyaniding the product, an economical recovery of the contained gold would be possible. After repeated experiment, the proposal had to be abandoned on account of the high cyanide consumption. The table concentrate is collected in boxes and periodically shoveled into cars, to be trammed to the drying-house.

RE-GRINDING. In order further to liberate the unreleased minerals in the table-tailing, it was decided to re-grind the coarser particles. To effect the separation, after a thorough trial of older methods as well as attempting to utilize the tables themselves as classifiers, it was decided to use a Dorr bowl type of classifier. The great difficulty of efficient classification on this ore, as previously mentioned, lies in the relatively high specific gravity of some of the minerals of the gangue and the relatively low specific gravity of the remainder.

For re-grinding an Allis-Chalmers ball granulator, 5 ft. by 5 ft., is employed, using concavex and plain 1½-in. diam. cast-iron balls. A 10-hp. motor serves to operate the bowl classifier as well as the 3-in. closed runner Byron Jackson centrifugal pump, which returns the reground product to the primary-flotation feed. For the ball-granulator, a direct-connected 75-hp. Allis-Chalmers motor is used, which, however, only consumes on an average 50-hp. to operate the mill.

The bowl-classifier is operated at 15 strokes per minute. So dense is the oversize in the bowl that if the power is off, even for one minute, it sets so hard as to necessitate digging it out before the machine can be re-started. Two systems of water addition have been tried, firstly the usual practice of adding it above the rakes, and secondly a double water-upcast through the connecting orifices between the bowl and the rake-tank. The latter method has given us the cleaner product and seems eminently satisfactory.

The bowl of the classifier serves also as a froth-trap. Suspended above the surface is placed a deflecting baffle-board, which skims the froth and directs it into a pipe connecting with the re-grinding mill discharge, and by adjustment of the amount of water flowing out with the

feeds the density of the re-ground tailing is kept constant.

In the re-grinding mill the best results are obtained on a dilution of 30% water. Worn-out balls and concavex pebbles that finally work out of the mill through the gratings are caught on a ½ in. heavy wire screen placed in the discharge box.

The liners in this mill seldom last over five months and we have had linings that were worn out in three months. The heaviest wear appears to be upon the feed-end headlinings. The ball consumption has averaged about 0.4 lb. per ton of ore treated or approximately 2.4 lb. per ton of tailing re-ground.

Screen Analyses

Mesh	Feed, %	Product, %
On 65	4.0	0.0
100	26.0	5.0
150	32.0	12.0
200	13.0	9.0
-200	25.0	74.0

Slime Plant. This plant is situated about 200 ft. from the main mill-buildings. The overflow from the bowl-classifier is pumped over by means of two direct-connected 4-in. Krogh centrifugal pumps—each operated by a 10-hp. motor. The difference in elevation between inlet and outlet is approximately 22 ft. and the total tonnage handled daily is approximately 3600 tons of tailing and water (1:7 dilution), the additional water resulting from the tables and bowl-classifier.

The pulp is distributed over 12 cement strakes, each 4 ft. wide by 50 ft. long, the inclination of which is 1¾ inch per foot. This inclination has been found to be too steep, and better results were obtained with a slope of 1¼ inch per foot.

The strakes are made of a bed of 3 to 6 inches of concrete, tamped level (horizontally) upon which a dressing of ¾ inch of 1:1 cement mortar is carefully troweled. When this is nearly dry, a small amount of dry cement is dusted on and again troweled. After this the strake is carefully combed transversely, thus forming a finely riffled surface. The wire-comb used should have teeth about ¼ inch apart. After setting for three days, the strake is ready for use.

One man attends to each four strakes and washes them down with a hose in sequence. The tailing is laundered to the final dump and the concentrate is returned to the mill by a 2-in. Krogh slime-pump. The concentrate is re-cleaned on a Deister Simplex finisher table, the concentrate being mixed with the other table-concentrate and the tailing joins the other table-tailing.

The saving in the slime-plant is about 10 cents per ton. To increase this saving, numerous table-tests have been carried out; Deister slime-tables, Union vanners, and Overstrom Universal tables have all been tried. So far the best results, when saving and capacity are jointly considered, have been obtained with the Overstrom Universal table.

Each machine saves practically the same amount per ton, namely, 30 to 50c. per ton, dependent upon the grade of tailing being treated; but in capacity the Overstrom table is ahead of the Deister slime-table or the Union vanner on this material.

Drying House. Situated 100 ft. from the bottom of the main mill-building, the drying-house is connected to the flotation-concentrate thickener, and the concentrating-floor by 2-ft. tracks, which run the entire length of the building.

To provide a simple and efficient means of drying the concentrate before sacking and shipping, a special type of drying floor is employed. Each furnace heats a floor 15 by 40 ft.; two fire-boxes are built together; similarly, two stacks are built in one. Underneath the floors are staggered brick baffles, built 24 in. on centres, forming one long flue 330 ft. from the bridge of the fire-box to the top of the stack.

The floor proper is composed of concrete slabs, which are reinforced by using four-point 4-inch barbed wire made up into 3-in. openings, and set ¾ inch from the underneath side of the slabs, which are 2½ in. thick. The concrete is made of a mixture of 1:2:4, using washed sand and ¾-in. gravel, hand tamped into wooden molding boxes. The edges of the slabs are cast with a ship-lap joint to prevent concentrate penetrating through to the flues when dry.

The floor slopes toward the stack end of the floor, where the concentrates are dumped wet, at a slope of ¼ in. per foot with the exception of the last three feet, which slopes at one inch per foot to provide for quick drainage of the settled water. For this water, a drain runs the whole length of the building and empties into a trap.

The cars are dumped directly onto the cool end of the floor and allowed to drain. As the concentrate dries, it is gradually raked by hand to the upper or fire-box end of the floor until dry. Here the dry concentrate is sacked hot, sampled, the sacks sewn up and weighed ready for transport by bull-carts to the railroad, 45 miles away.

The fuel consumption averages one cord of wood (inferior and probably not more than ⅝ of the U. S. cord) for every four to five tons of concentrate per annum, which covers a wide range of temperature. Winter months require about one cord for three tons, whereas in summer one cord will dry six tons.

The final moisture in the dried and sacked concentrate averages 0.3% regularly.

In isolated localities with a reasonably cheap fuel and labor supply, this system of drying flotation concentrate has much to recommend it, as the whole plant can be constructed of local material cheaply and the maintenance is practically confined to the yearly renewal of a few concrete slabs that are immediately exposed to the heat of the fires. The building being enclosed and the concentrate being delivered to it in a wet condition, the loss from dusting is practically nil.

The method of heating the floor is a copy of the method used by Koreans and Chinese to heat their houses, and the fuel economy is a tribute to Chinese thrift. This method of heating has been adopted with success in foreign dwelling houses, and when these floors, or *kangs*, as they are called locally, are designed carefully they will keep a house warm in the coldest climate with a minimum fuel consumption, as compared with stoves or other methods of heating.

In the original construction of the drying floors at Tai Mi Chung insufficient allowance was made for the expansion of the whole floor when heated, with the result that one of the end-walls of the building was dislodged about three inches. Subsequently allowance for expansion was made by providing a space of six inches all round the slabs at the sides and ends filled with loose dry tailing, and this obviated any further difficulty from this cause.

The cost of drying concentrate by this method, including sacking, sampling, sewing, and weighing is 90 cents per ton of dry concentrate with wood at $2.25 per cord and labor at 25 cents per day of 10 hours. The cost of the concentrate drying-house at Tai Mi Chung amounted to $8194.93.

The capacity of this drying-house depends on the fineness of the concentrate. At Tai Mi Chung the flotation concentrate is extremely fine and 97% of it will pass through a 200 screen. The table concentrate, which only forms a small proportion of the material sent to the drying-house, is much more rapidly dried. On flotation concentrate the capacity of the drying-house, which consists of six floors, is from 30 to 35 tons per day. With the addition of the coarse and more granular table-concentrate the rate of drying would be increased.

Power Consumption. The following tabulation shows the actual power consumption for each section of the mill, calculated over the year 1918, in which period 154,300 tons of ore was milled.

	Kw-hr per ton
	1.8018
	14.9446
	2.8027
	0.2283
	2.4231
	0.7569
	0.2400
	23.2214
	2.0169

Mill-Labor. Each shift is under the supervision of a foreign shift boss, and the whole mill is under the direction of the mill-superintendent.

The distribution of labor is as follows:

			18
			7
			3
			12
			9
			3
			9

Accessory labor comprises laborers, sampler, and interpreter, bringing the whole crew up to 71 natives.

The motors are under the charge of Japanese electricians, one man being detailed to each shift with a Korean helper.

Cost of Milling. The following tabulation shows the cost during 1918. In this year, owing to the effect of war conditions, all costs were increased above the average of previous years, and, doubtless, with the resumption of more normal conditions, future operating costs will show a reduction. As one instance of the manner in which operating costs were affected, the cost for power per ton milled in 1918 increased 68% over the corresponding cost for the previous year. The following cost includes all foreign supervision.

Tai Mi Chung Mill Cost Per Ton Milled 1918
154,300 tons milled

	$	$	$	$
	0.0643	0.0322		0.1143
				0.0033
	0.1184	0.0343		0.1443
	0.0788	0.0174	0.0074	0.1310
	0.0074	0.0035		0.0127
	0.0043	0.0036		0.0081
Tailing-elevating	0.0011	0.0137		0.0148
	0.0026	0.0050		0.0104
	0.0019			0.0019
	0.0034	0.0028	0.0002	0.0064
	0.0316			0.0316
	0.0069			0.0069
				0.0004
	0.0155		0.0158	0.0313
	0.0076			0.0076
	$0.6184	$0.1367	$0.1342	$1.1893

Note: [illegible]

Quantity and Cost of Supplies and Labor

		$1 [illegible]	$0.0081
		1 [illegible]	0.0010
		10 [illegible]	[illegible]
		51 [illegible]	[illegible]
		[illegible]	[illegible]
		[illegible]	[illegible]
		10 [illegible]	
		3	
Rope, ¾ in.	.....	4.59	
Conveyor-flights, 325 pieces	.....	725.77	0.0046
		3 [illegible]	[illegible]
Steel balls, 57,998 lb.		$1,251.13	$0.0310
		$18 [illegible]	0.0052
		1,0 [illegible]	0.0461
		10 [illegible]	[illegible]
Eucalyptus oil, 69,842 lb.		1 [illegible]	[illegible]
		[illegible]	0.1625
Nails, 653 lb.	.....	85.77	[illegible]
	.....	130.00	[illegible]
		1,5 [illegible]	[illegible]
Electric lamps, 727 pieces		183.4 [illegible]	[illegible]
		[illegible]	[illegible]
		1 [illegible]	[illegible]
		1 [illegible]	[illegible]
		[illegible]	[illegible]
Ball-mill liners	.....	1 [illegible]	[illegible]
		41 [illegible]	[illegible]
	.....	876.00	[illegible]
Ore estimate and survey D. C.	.....	156.77	[illegible]
		1 [illegible]	0.0336
		8 [illegible]	[illegible]
Maintenance of mill employees		1 [illegible]	[illegible]
		[illegible]	0.1310
	.....	3,500.13	[illegible]
Pay-roll: Japanese		1 [illegible]	0.0807
Pay-roll: Native		11,971.83	0.0776
		$188 [illegible]	$1 [illegible]

The mill-crew consists of Koreans and [illegible] are extremely satisfactory. The electrical power-plant is entirely operated by Japanese, who also attend to the motors driving the mill-machinery, compressors, etc.

The following are the rates of pay as in force on the property.

Rates of Pay for Korean Laborers

	$	
	10	20
	10	[illegible]
	8	[illegible]
	8	[illegible]
	10	[illegible]
	10	[illegible]
	8	[illegible]
	8	[illegible]
	10	45–50
	10	45–
	10	30

All these laborers provide their own food and [illegible]

(To be continued)

Present Problems of the Mining Industry

By Van H. MANNING

*It is a pleasure to be again in the city of St. Louis and to speak before the American Mining Congress, for my memory at once brings back vividly those days, 15 years ago now, when my honored late chief, Dr. J. A. Holmes, was with the help of his colleagues, Messrs. Campbell and Parker, beginning here in St. Louis the fuel-testing work in connection with the Louisiana Purchase Exposition that later led to the creating, first, of a technologic branch of the U. S. Geological Survey, and, later, to the establishing of the Bureau of Mines, of which he was the first Director, and to which the memory of his wise leadership and far-seeing vision will always be an inspiration. I remember too that two years previous to that he had been chairman of the committee on permanent organization of the International Mining Congress, as it was then known, when it met at Butte in August 1902 to devise some means by which its work could be made of greater value to the mining industry and lay down the basis of a permanent organization toward that end. The Bureau of Mines and the American Mining Congress therefore both owe to this one great man the formulation of wise policies and the outlining of great aims that have borne fruit in the continued growth and greater usefulness of them both. They are linked together too in the undoubted fact that the resolutions passed at the meeting in Butte, as well as in preceding and later meetings, stating that on account of the importance to the country of the mineral industry a Federal Department of Mines and Mining should be created, greatly facilitated securing the appropriations that made possible the establishment of the Bureau of Mines in 1910.

When I have appeared before you in former years it has been my custom to speak to you briefly of the work of the Bureau of Mines, but I no longer feel that that is necessary. In the past decade the aid given by the Federal government toward the encouragement of the mining industry has so far justified itself that the Bureau has been able to extend its work throughout the mining districts of the country, and what it has been doing is doubtless known to you through personal contact with its agencies. I say this the more confidently because of the cordial co-operation the Bureau has received from the men of the mining industry. It cannot be necessary, therefore, to explain and define the Bureau in the house of its friends, and I want to draw to your attention a few of the main general problems that confront the mining industry and to indicate what in my judgment seems to be the most desirable way in which their solution should be attempted.

*Abstract of an address delivered by the Director of the U. S. Bureau of Mines before the American Mining Congress at St. Louis on November 17.

We are confronted today with what is perhaps the most serious industrial trouble that the United States has ever had. I refer, of course, to the coal strike. It is not my purpose to attempt any discussion of the merits or demerits of the case of either side of the controversy, and I hope, with you all, that the dispute will be settled soon, but since it is the function of the Bureau of Mines to foster the mining industry, I feel it my duty to discuss one problem which has concerned both the miners and the operators in the past, and that is, the frequent periods in which the bituminous mines, especially in the spring and summer months, are not at work from causes not under the control of either the operator or the miner. As you are aware, these unwelcome shut-downs constitute a considerable percentage of the possible number of working days in a year, and thus seriously affect the gross income of both the miner and the operator, since each suffers a loss whenever the mine stands idle. Unfortunately the roof does not stand idle—it falls and must be timbered, and water enters the mine and must be pumped out. These, and other necessary operations cause a loss for which there is no compensation.

In the 5-year period, 1912 to 1916, the time worked in the bituminous mines ranged from 195 to 232 days, out of a possible 310 working days. In 1917 the mines worked 243 days, and in 1918, under the abnormal war conditions, 249 days. In round figures, the mines are idle for one-third to one-fourth the time in ordinary years. The reason is well known to you: the bituminous mines are opened and manned on the basis of the maximum or winter output, which in large part arises because consumers reduce their purchase of coal in the spring and summer.

Although some bituminous coal does not stock well, yet there are ways and means by which this can be done, but it requires careful storage, and the storing and re-handling cost money. The trouble is that the consumer does not perceive the cost of this to himself. He thinks to himself, it is all right for Jones to buy his coal early and in this way help out the miners, but it is going to be inconvenient for me to tie up my money so far in advance, and so he does not order coal early in the season. It must, therefore, be made worth while to the consumer from a money standpoint. If a business firm uses a thousand tons of coal per year and could save a thousand dollars by buying early, is it not likely that it would make its purchases early, although it might have to spend half this amount in re-handling? On the other hand, it would be a further advantage to the company to know that it would have its supply of coal on hand when the winter storms tied up the railroads.

Since Congress by law has prevented agreement among operators as to price, it becomes impossible for them to

take care of this situation by agreeing to sell their coal at a loss in summer and making it up in winter. It has been suggested that this could be taken care of through the Government establishing summer and winter rates on coal, so fixed that there would be no loss of net revenue at the end of the year; or, still better, establishing a sliding scale that would produce an equalization of coal purchases and shipments through all the months of the year.

The effect of this would be that the miners would have steady work and there would be readjustment by which fewer mines could furnish the total amount of coal needed. This would not necessarily mean the shutting-down of mines, for coal production in 1918 was 113,000,000 tons, or 20% greater than in 1913, and if new mines were not opened for awhile productive capacity would quickly become adjusted to consumption. Fewer miners would be required, and we would have the advantageous condition in this country, which prevailed in Europe before the War, where the miners worked practically every working day in the year, and the operators were able to count on a regular output.

* * * * * * * *

I cannot overlook this occasion to call your attention to a situation that now exists regarding the international policies in the development of the mineral resources of the nations of the world. A number of countries have recently inaugurated policies tending toward the exclusion of other than their own nationals in the acquisition of mineral resources, more particularly oil, within their own domains and spheres of influence. This is a situation in which all Americans should interest themselves and in which the American Mining Congress should be particularly concerned.

There are two phases of the situation, one with reference to the larger nations, the other with reference to the smaller nations. Mining men are more or less familiar with the situations that exist in Latin-American countries. It is probably not as well understood that the stronger nations have instituted policies which will exclude Americans from acquiring holdings in their domains or spheres of influence on a scale that will encourage our nationals. These policies have been the outgrowth of the recent war and the intense nationalism which has been accentuated by the struggle for existence which the nations have undergone. As a result we find that each nation manifests a desire to meet their own needs first, and these desires are being pushed in a manner that is both short-sighted and, in the end will, in my opinion, react upon itself. This policy has been centred around the petroleum situation because the War has brought home to every nation the vital importance of petroleum in war and in peace. Petroleum as a source of motor-fuel, as a source of the only lubricant that can be obtained in sufficient quantities, and as needed for the marine of the world, both naval and merchant, is becoming one of the primary necessaries, militarily and industrially, of our modern world. Up to the present time, the United States has been in a dominant position as far as petroleum resources are concerned, and has produced from 60 to 70% yearly of the world's total supply, but likewise, the United States with its industrial life promised upon the productivity of each man being multiplied by the use of machinery has come to be a consumer of petroleum and its products in greater proportion than its actual production. We can no longer meet our domestic demands from domestic resources, and our best engineering talent tells us that looking both from a question of supply and from the question of demand, the situation will grow progressively more critical until such time as the oil shales of the West can be developed on a large scale and in commercial competition with the oilfields, not only of the West, but in the world without the confines of our United States.

We find ourselves, therefore, compelled to go abroad for an increasing proportion of our oil. We are importing an increasing amount of crude oil from Mexico; we are desirous of extending our internal consumption of oil for all purposes and we are endeavoring to build up a merchant marine that we are told can compete with the marine of other nations only by the use of fuel-oil. We are in danger, therefore, of finding that the margin of need over domestic supplies cannot be made good by our own nationals abroad, but only from our commercial and political rivals if these policies that are likely to prevent our nationals from entering into and exploiting foreign supplies, are maintained.

It has always been the policy of America to encourage foreign capital to enter freely, and for foreign companies to acquire holdings in the United States on a parity with our own nationals. I believe in this policy. I believe that in the long run this country will benefit more by such a policy than by endeavoring to restrict all the benefits to ourselves. I believe that the policy of national selfishness is short-sighted and may lead to serious international complications, and in the long run this country will benefit more by having reasonable exchange of opportunities between ourselves and other nations. I believe that the exclusion policy is short-sighted on the part of those nations that have initiated it, for, if persisted in, I am of the opinion that public sentiment will demand that the nationals of such countries be excluded from our mineral resources to the same extent that they exclude our citizens. I believe that if this tendency of erecting a Chinese Wall around each country is universally adopted, the United States will suffer probably less than any other country, for it has within itself resources that make it the most nearly self-sufficient. For many resources it has such an overwhelming superiority that other countries are more dependent upon us than we are upon them. However, the United States is in better position to bring this fact home clearly now than probably it ever will be again in the future. It would be unfortunate if, because of inaction on our part now, these intense nationalistic tendencies of other nations are allowed to crystallize into fixed policies that cannot be changed. It would be deplorable if the situation develops to such an extent that we are forced to retaliate

[illegible] the nationals of other countries from acquiring mineral holdings in the United States; therefore I commend to the American Mining Congress a policy to be supported by it of urging a reciprocity that will place our citizens upon a parity with other nationals in the exploitation of the universal resources of the world.

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In the utilization of fuel-oil, there is an unlimited field of investigation. Though petroleum is the cheapest of combustible liquids its peculiar properties should be utilized to the fullest extent, and it should not be used in direct competition with coal and other fuels that are more abundant. Petroleum products should not be burned for direct heating purposes, as under a boiler, except under extraordinary circumstances.

The extensive use of fued-oil for steam-raising should be discouraged, since the thermal efficiency obtained is only 10 to 15% in the average steam-plant, whereas in internal-combustion engines from 30 to 36% can be obtained. The internal-combustion type of engine for the heavy petroleum products, which constitute about 57% of the petroleum in the United States, should be developed so as to use this ideal fuel in a more efficient way. At the present time fuel-oil is the chief concern of the refiner and is sold at an actual loss in most cases, for a gallon of fuel-oil usually sells for less than a gallon of the crude oil from which it has been obtained. The questions of obtaining more gasoline for the increasing number of automobiles, trucks, and tractors, is also a great problem. It does not seem as if we could distill a much greater portion from crude oil, because we have already encroached upon the kerosene fractions to such an extent that it is likely that an economic equilibrium between the prices of the two products will soon be reached. More gasoline can be obtained by cracking fuel-oil, but it seems to me more desirable, if it can be done, to develop internal-combustion engines that will use the fuel-oil directly without cracking it. For a gallon of fuel-oil so used, we get about 30 to 35% thermal efficiency; whereas the same gallon of fuel-oil if manufactured into gasoline yields only 20 to 25% thermal efficiency and the cost of producing the gasoline is considerable.

The exploitation of oil-shale is also a problem of the first magnitude. It is probable that sooner or later we must fall back upon this source of supply, and we should take steps to find out, at the earliest opportunity, how the oil from the shale may be best obtained, whether it can be obtained profitably at the present time, and if not, under what conditions the exploitation of these deposits can be made profitable.

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Perhaps the largest problem of all is the development of competent engineers and technologists to solve these problems. Along some lines capable engineers have been developed, but along others they are woefully lacking. This is particularly true in production. There is need for the trained engineer who is willing to go into the oil-fields and acquire first-hand experience of the practical side of the business. This is, I am confident, one of the biggest openings for engineers and will be of the most benefit to the industry. The engineer who tries to work into the oil industry from the top is not the one who is going to meet the situation. On the other hand, there is need for an awakening upon the part of the oil industry as to the possibilities of practical application of scientific engineering ability. I do not say this as a criticism, for the practical oil-operator has accomplished wonders for himself, and if he has not taken engineering sufficiently into consideration, this is largely because there have not been engineers available who were competent to reduce his problems to an engineering basis.

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The non-metallic minerals form a field for research and investigation, the importance of which is often not fully appreciated. The problems in this field are many and varied, though perhaps more elemental than in the metal-mining field, for but little technical work has been done here by mining men. But during, and since, the War, the great importance of the non-metallic minerals has begun to be realized, and it is probable that a new era of research is about to begin. To those not closely familiar with this group of minerals the great lack of even fundamental information can scarcely be realized. Little technical literature exists and comparatively few consulting engineers can be found who can bring both knowledge and experience to bear on technical problems in such minerals as clay, cement, gypsum, talc, mica, and fluorspar. The Bureau of Mines has long realized the importance of work in this field and has already published bulletins and technical papers dealing with feldspar, kaolin, fuller's earth, marble, sandstone, salt, and gypsum that cover the subjects in a preliminary way. Under the War Minerals Investigations, and its outgrowth, Minerals Investigations, specialists were assigned to many of the most important of the non-metallic substances and a foundation was laid for more detailed work.

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During the War the supply of many of our raw materials in many cases were reduced to the minimum, many others were taxed to the utmost, and at times we faced a serious shortage. These limitations placed upon many of our resources were due to our military demands. Therefore, any consideration of a plan for national security must comprehend the nation's self-sufficient supply not only of our military necessaries, but for an economical extension of our domestic resources wherever possible to meet the increasing needs of our army, navy, and the public. The welfare of a nation is dependent upon its resources, and the industrial development and general prosperity depend upon the adequate supply of the many materials that make for the life of the nation.

In mentioning these things, the point I wish to clearly emphasize is that the Bureau is fully cognizant of the necessity for extensive, careful, and systematic research and investigational work in order to meet the problems that are now confronting the mineral industry and that must continue to confront it if we are to develop our resources to the best advantage.

Individualism v. Nationalization

By P. B. McDONALD

The question whether great industries should be nationalized or retained open to individual initiative is being argued by some of the keenest minds in Europe and America. An official of the National City Bank in New York has drawn an interesting picture by suggesting, apropos of the death of Andrew Carnegie, that if that great manufacturer of steel had had to explain his plans and steps to Congressional committees and convince provincial politicians that steel mills should not be apportioned around the country as improvements on rivers and harbors are, what a time he would have had! The same argument made plain that a great capitalist, such as Carnegie or Mr. Ford, consumes very little more after making his millions, than he consumed as a poor man, and that his large fortune mostly goes back into the business that he has created or else is directed to philanthropy; that is, he is an efficient agent for the public good, producing much and consuming little.

Another decided individualist is Harold Cox, editor of the 'Edinburgh Review'. His opinion on the nationalization of British railways is that such a policy would create an institution too vast for any man to manage, and that inevitably the human element, which now survives in spite of great trusts and corporations, would be eliminated. As to Sidney Webb's contention that nationalization would bring economies in the restriction of useless competition and the unnecessary duplication of services, Mr. Cox believes that the economies that could thus be effected would be counterbalanced by the inefficiency of management that follows the attempt to do things on too big a scale. Says Mr. Cox: "It is not very edifying, but it is the fact, that when the House of Commons considers the naval estimates the only members who are sure to be present are the representatives of constituencies in which there are dockyards. . . . Commercial men are frankly selfish, but on the whole their selfishness works out for the public advantage; state officials under a nationalization scheme are supposed to work only for the good of the nation, but in practice their own human natures are unequal to the strain."

In a series of letters in 'Everyman' the point was advanced that, while a cabinet minister may earn $25,000 per year by valuable services to the State, a financier who receives $250,000 per year from an investment in a factory does not earn that amount. A thoughtful answer to this stricture explained that the man who receives a very large return from an investment does so because efficient capitalists are exceedingly scarce. The State would probably be an inefficient capitalist; I was reading recently of a canal dug by the British government to connect two lakes in Ireland; when the water was allowed to flow in it sank through the porous rock that bottomed the expensive excavation, and the whole work was a failure.

There is no doubt that individualism develops shrewd, daring, forceful men, and that bureaucracy tends to the policy of 'dilly and dally' and 'delay, linger, and wait a little'. Yet Ruskin and Carlyle taught that excessive competition brought 'cheap and nasty' products, fear, and waste. In a recent number of the 'Anglo-French Review', A. Emil Davies, who is general manager for the British, Foreign & Colonial Corporation, advanced a surprising defence of nationalization. Mr. Davies said in brief that publicity might be made an effective safeguard against the vices of bureaucracy and that the faults of a democratic electoral system are merely the reflected faults of the community that is served. This latter point recalls Mr. Cox's remark about the indifference of electors to tedious parliamentary procedure unless a direct advantage is to accrue, as in the case of "the representatives of the constituencies in which there are dockyards".

Faults in bureaucracy, says Mr. Davies, are the faults of the governing class which dominates both government and business. "This class," he continues, "is on the whole, incompetent and not even educated . . . Large and successful businesses . . . stand a great deal more inefficiency and waste than people imagine . . . By the time the ordinary big business became bankrupt through the inefficiency of its principals, public criticism, in the case of a government or municipal department similarly mismanaged, would have become so great that the faults would have to be remedied." This is a remarkable accusation, and quite the opposite from conventional opinions on the subject. Mr. Davies is intimating that private businesses, even though successful, are often more wasteful than government management providing the latter is publicly and freely criticized. As an argument against this sweeping arraignment, beyond the general truth that nature and life itself are inefficient, the individualist who was quoted from 'Everyman' could be invoked again. That writer pointed out that an incompetent cabinet minister, or other important official in government, can, and does, involve the government in debt or blunders and then resign, not greatly damaged himself, while a capitalist who gets into a predicament has to pay the price.

As to the waste involved in excessive competition, Mr. Davies instances two English railroads carrying passengers to Portsmouth. Each put up a colored poster on station platforms advising travelers to the south coast to go by its route. Now, "the proportion of people who saw those posters and desired to go to Portsmouth would be very small—and what did it matter to anyone, except the respective shareholders, whether they went one way or another? Yet there were people designing these posters, printing them, making and keeping in repair the boards on which they were affixed; there were bill-

posters employed in pasting them up; all these people had to be kept and clothed, and yet, so far as the community is concerned, practically all their labor represented nothing but waste."

Against this perhaps hypercritical censure there could be arrayed all the tremendous arguments of the advertising men—the products and time-savers made possible by advertising campaigns, the raising of the level of civilization by the suggestions conveyed in advertisements, the enormous diffusion of modernity to the farthest corners of the earth, etc. Referring to the post office, Mr. Davies hints that under purely commercial operation, as opposed to government management, a charge of a shilling might be made on a letter to Australia, while from one London suburb to another a halfpenny might suffice. Such is the "resiliency and spirit of accommodation" claimed for individual enterprise, compared with the flat rates and standardization of nationalization.

From these typical arguments for and against government ownership it can be seen how important is the bias and personality of the man who is talking. Out of the conflicting criticisms stands the undoubted fact that the policy of government ownership is gaining ground. To what extent the movement is due only to a vague dissatisfaction with present conditions rather than to a real belief in the soundness of the principles of nationalization, and whether or not a reaction will swing the pendulum back to individualism, are questions that can be answered only in opinions. Stephen Leacock, professor of political economy at McGill University, declares that the competitive industrial system needs much more intelligent directing, but that Socialism, which of course includes nationalization, is "a beautiful dream".

Radium Minerals

Radium minerals are generally found in connection with granitic masses—that is, in places where granite forms at least part of the rock of the country. Most of the original radium minerals, such as uranite, samarskite, and brannerite, are black and have a shiny fracture and a high specific gravity. These minerals are rarely found in commercially valuable quantities. Pitchblende, which has the same composition as uranite and the same general appearance except that it shows no crystal form, occurs in veins. It has been found in only a few places—in Bohemia, southern Saxony, Cornwall, and Gilpin county, Colorado. When these original minerals break down through weathering, other radium minerals are formed from them, such as autunite, torbernite, carnotite, and tyuyamunite.

Carnotite and tyuyamunite are the most abundant of these minerals and now furnish the bulk of the world's radium. They cannot be told apart by the eye, for both are of bright canary-yellow color and are powdery, finely crystalline, or, rarely, claylike in texture. Carnotite is a hydrous potassium-uranium vanadate. Tyuyamunite is similar in composition but contains lime instead of potash. The greatest known deposits of these two minerals are in south western Colorado and south-eastern Utah, where both are associated with fossil wood and other vegetation in friable, porous, fine-grained sandstone. Small quantities of carnotite have been produced near Olary, South Australia. The only other deposits that yield tyuyamunite in notable quantity are those of Tyua-Muyun, in the Andiyan district, Ferghana Government, central Asiatic Russia (Russian Turkestan), where tyuyamunite occurs with rich copper ores in a pipe in limestone.

A drop of strong hydrochloric acid on either carnotite or tyuyamunite gives it at once a rich reddish-brown color, and the addition of a drop of water immediately changes the color to yellowish green. The reddish-brown color shows the presence of vanadium, and the yellowish-green color the presence of uranium, for if vanadium alone were present the color would be clear green or bluish green. Iron, however, may interfere with the test, producing a color that covers or masks the others. Surer tests may be made either with an electroscope or with a photographic plate. If a piece of radium-bearing ore is placed on a plate-holder containing a sensitized plate with only the cover of the plate holder between the specimen and the sensitive film of the plate, the plate will be 'light struck' in from 24 hours to 4 or 5 days, the length of time consumed depending on the richness of the specimen. Specimens should never be placed on the plate itself, because the pressure of the specimen will give an effect that simulates light striking. This test may be made with other uranium minerals to which the acid test given would not be applicable.

Radium is a metal and is described as having a white metallic lustre. It has been isolated only once or twice, and few persons have seen it. It is ordinarily obtained from its ores in the form of hydrous sulphate, chloride, or bromide, and it is in the form of these salts that it is usually sold and used. These are all white or nearly white substances, whose appearance is no more remarkable than that of common salt or baking powder. Radium, radium salts, and radium minerals are not generally luminescent. Tubes containing radium salts glow because they include impurities which the radiations from the radium cause to give light.

Radium is found in nature in quantities so exceedingly small that it is never visible even when the material is examined with a microscope. Radium ore ordinarily carries only a small fraction of a grain of radium to the ton, and radium will never be found in large masses, because it is formed by the decay of uranium, a process that is wonderfully slow; and radium itself decays and changes to other elements so rapidly that it does not accumulate naturally in visible masses.

QUARTZ LODES in the Willow Creek district, Alaska, where mining has been done since 1908, have yielded more than $1,600,000 in gold and silver and are still being worked profitably. The character of the deposits and the work done in the district in 1917 are described in a report by S. R. Capps, in Bulletin 692-D of the U. S. Geological Survey.

The Goldfield School of Mines

By M. A. FARRELL

Nevada has four secondary mining schools, one each at Goldfield, Tonopah, Ely, and Virginia City. Until September 1 of this year they were under the direction of the University of Nevada and were operated as affiliated organizations, supported by the State and Federal government and supervised by Francis Church Lincoln, dean of the Mackay School of Mines of the University of Nevada. Prof. Lincoln was the founder of the schools. They are now operated under direction of the county Boards of Education in co-operation with the State Board of Vocational Education and are under supervision of R. A. Jones, State Director of vocational work. Prof. Lincoln is still connected with the schools in an advisory capacity. After December 31, 1920, they will be maintained as County, State, and Federal enterprises, with the County and State each providing one-fourth of the cost of salaries and the Federal government one-half under the terms of the Smith-Hughes Vocational Education Act. The cost of supplies will be borne by the counties. The act changing the control provided for a fifth institution in White Pine county, which it is planned to have at McGill, where the smelters for the Ely district are situated.

Photo by Tone Goodheart

LABORATORY OF THE GOLDFIELD SCHOOL OF MINES

The Goldfield institution is in a two-room stone building formerly used as a primary school, and it has the best quarters and equipment of the four in the State. Everything is provided for complete courses in all subjects taught and the work is arranged so as to hold the interest of the pupil and demonstrate to him the practical side throughout the course. An excellent collection of minerals is used in connection with text-book instruction in the physical properties, structure, and composition of minerals, and the well-equipped laboratory provides for determinative analyses of ores. The courses provide for a minimum of instruction from text-books, resulting in the interest of the pupil being held if he has ordinary ambition. Men can be fitted for every position in mining and milling up to assistants to cyanide and flotation metallurgists. They may become assayers, mill solution men, cyanide or flotation plant foremen, geologists' assistants, or ordinary operators of machine-drills.

The schools are in session 30 hours weekly and that in Goldfield is open five hours daily except Sunday, two hours in the morning and three in the evening. Courses are offered in mineralogy, explosives, mining business, volumetric and fire assaying, surveying, mechanical drawing, dynamic geology, cyanidation, flotation, and chemistry. There is no charge for instruction and practically all text-books are furnished free. The entire process of oil-flotation is ilustrated in Goldfield with a model of the Callow pneumatic flotation-machine. The

machine takes a charge of 200 grams of pulp, which an air-lift returns to the top of the machine, providing continuous operation when desirable. With the present equipment a cyanide plant could readily be constructed. Publications devoted to mining and reference books on technical subjects are provided for use by anyone interested. The principal and only instructor is G. E. Hoffman.

The school has been attended by miners, millmen, machinists, prospectors, surveyors, hoist-engineers, mine-blacksmiths, samplers, 'divining-rod experts,' a Methodist minister, railroad-men, lawyers, doctors, grocery-clerks, a dry-goods clerk and his wife, bookkeepers, grocery store owners, truck-drivers, real-estate men, a telegraph operator, a newspaper editor, a saloon-keeper, who attended regularly day and night for many months after the State went dry, and high-school pupils. This list of occupations shows a startling variety and indicates the difficulties in the path of the instructor. Their knowledge of everything from minerals to the English language differs greatly, as their previous education ranges from practically none to a complete university course. One pupil studying mineralogy quit because the names of the minerals were too difficult to pronounce, and a prospective geologist, taking the course largely for the practice in reading he thought it would provide, found there was a difference between a book on geology and a first reader. A Swedish-English dictionary was the constant companion of another pupil in his efforts to understand the instructor, in which he eventually failed. It was finally discovered that a man who had difficulty in titrating did not know the multiplication tables and he was given up as a hopeless case. A member of the geology class, wise beyond the time he had studied the subject, in wandering over the erupted Goldfield malapai, decided to his own satisfaction that the sun-blackened rocks scattered over the top were glacial deposits and thereafter was given to long and learned discussions on the subject of such deposits. A 'mine owner' found on examining the collection of minerals that he had them all on his claim, according to himself.

The allotment for the Goldfield school to cover expenses from July 1, 1919, to June 20, 1920, was $3144, of which the State provided $2700 and the Federal government $444. Of this sum $2400 was for the salary of the instructor and $744 was for supplies. The school at Goldfield, the last started in the State, was opened in June 1917. To date 115 pupils have registered, of whom only six have finished courses, due to the transient nature of the population of the town in the past. One pupil has been attending practically continuously since December 1917, another since May 1918, another since September 1918, and a fourth since October 1918. The school re-opened this year after the summer vacation on September 1 and in that month 21 pupils registered, 14 of whom are attending with fair regularity. There were no additional registrations to October 15.

These four schools are the only institutions of their kind in the State where men without high-school education are accepted. Each pupil receives an education worth several hundred dollars to himself and something to the mining industry. To the prospector the schools have been a benefit in teaching him that the so-called rare minerals are in many instances rare merely because he does not recognize them while on his trips, or mines for other minerals ore containing them. There are numerous instances of discoveries being made by prospectors with aid of the schools. The Goldfield school has been of far greater benefit to the community than the six men who have finished courses would indicate and, with the employment of from 300 to 500 men by the Development company, as planned, and the chances good for the Florence to increase the force of miners now employed, it is certain that the mining interests will make a firm stand to have the institution retained after December 31, 1920, through forcing an appropriation for support into the county budget despite the rumored opposition of some public officials on the ground of expense.

Diamond Mining by Diving Bell

An interesting scheme is about to be tried on the Vaal river, South Africa. A company called Deep Water Diamonds has been formed to carry out a project for recovering diamonds from the bed of the river by means of an air-lock caisson or diving bell. According to a description published by the 'South African Mining and Engineering Journal' of Johannesburg, the bell of the caisson has a diameter of 15 ft., giving ample space for several natives to work. The bell is specially designed for working in the deep pools and can easily be shifted from one pool to another, the whole structure being attached to pontoons that enable it to float in shallow water, from a foot to 18 inches deep. The bell is lowered into the water by means of water ballast, and the water is displaced by air pumped into the bell by compressed-air pumps. The interior is lighted by electricity, and has a telephone and signals installed and arranged for communication. The gravel is hauled up by a compressed-air hoist and is handled by purely mechanical means once it enters the skip. The apparatus is designed to work in any depth of water up to 65 ft., while the deepest pool in the Vaal in the dry season is only about 30 or 40 ft. On the deck there are boilers and a steam turbine for running the machinery, and an air-compressor for supplying the bell. There is a bin to accommodate the gravel brought up, a trommel for cleaning and classifying the soil, gravitators for separating the diamonds, and a sorting table. Previous attempts at obtaining diamonds from the bed of the Vaal river have been made by means of break-waters and suction or bucket dredges, but the latter method is stated to have proved unsuccessful because the bed of the river is a natural concrete of boulders and clay. Advices since received indicate that the idea of recovering diamonds from the Vaal river by means of a caisson is not new.

FROM OUR OWN CORRESPONDENTS IN THE FIELD

ARIZONA

COPPER PRODUCERS CURTAILING PRODUCTION.

DOUGLAS.—A spirit of pessimism was injected into the copper situation in this district by the dual announcement of the Phelps Dodge and Calumet & Arizona managements that production was to be materially cut, as a safeguard to maintain operations during the period of stagnation in the copper industry. At the Copper Queen smelter one of the four blast-furnaces that has been in operation for the last few months was shut-down. It was announced that the monthly output would be reduced from approximately 9,000,000 to about 7,500,000 lb., or about the same rate of production as last spring. This change in operation caused the discharge of approximately 35 employees. The Calumet & Arizona also will return to the level of last spring, closing one of the two big blast-furnaces and materially reducing the present output. Just what this will amount to, Harry A. Clark, superintendent, said he would be unable to say until after the first of December, by which time all plans would be worked out. In an interview here, Gordon R. Campbell, secretary of the C. & A. company, displayed distinct pessimism with regard to the immediate future of copper. Mr. Campbell, with Capt. Thomas Hoatson, vice-president of the C. & A. company, now is making the rounds of the Arizona holdings of the corporation. Although the C. & A. has determined to return to about the same level of production as last spring, according to Mr. Campbell, it has not been decided to reduce tonnage materially from the company mines in the Warren district, it being entirely possible that the same tonnage, but of lower grade ore, will be treated. The policy probably will not mean material reduction in force. The C. & A. will continue its development operations on its properties in the Warren district, doing pioneer work to open territory neglected of necessity during the War. Work at the Junction shaft, where development operations of the company centre at present, will be continued. Some good ore has been opened up recently in the direction of Cochise. The Phelps Dodge Corporation has issued a circular announcing the appointment of P. G. Beckett, now assistant to the president, as general manager with headquarters in Douglas. A. T. Thomson, assistant to the president, will return to the New York office. T. H. O'Brien, now manager of the Stag Canyon branch, is appointed manager of industrial and public relations and consulting engineer of the Stag Canyon branch, with headquarters in Douglas. W. D. Brennan, formerly general manager for the Union Pacific Coal Company, is appointed manager, Stag Canyon branch, Dawson, New Mexico. All changes are effective January 1.

MIAMI.—An inspection visit to the properties of the Inspiration Copper Company and International smelter was made by C. F. Kelley, president of the Anaconda Copper Co.; L. D. Ricketts, vice-president of Inspiration Consolidated and International Smelting companies; William Wraith, manager for the International Smelting Co.; and T. F. Conrad, secretary to Mr. Kelley. Production at the Inspiration Consolidated remains at about the same rate, that is, about two-thirds capacity. The concentrator is operating from 14 to 15 sections, depending upon slight fluctuations in the ore supply from the mine. The Miami concentrator is operating from 4 to 5 sections or approximately 4500 to 5000 tons daily. The construction of the new hoist-house at No. 5 shaft is nearing completion, the frame work and covering of the building being finished. Erection of the new steel headframe is proceeding rapidly, the back panel being more than half completed. The new man-hoist is nearly in place and should be in operation in a month or five weeks.

Gibson Consolidated has settled down to a steady working basis of milling dump ores and getting the mine in shape for production from underground. The concentrator is operating three shifts regularly, handling 130 to 160 tons of ore daily, producing about 11 tons of concentrate. Most of this ore comes from the dumps. An incline-tramway, operated by a steam-hoist, is in operation in recovering ore from the dump. The ore is loaded into mine cars by use of Indians and then hoisted to the crushing plant by the tram. Repair work in the shaft below the 200-ft. level is proceeding satisfactorily and the shaft will be in position for operation by the time the bad weather interferes with recovery of ore from the dumps. Shaft No. 1 of the Van Dyke Copper Co. now is 510 ft. deep. Sinking has been facilitated by the installation of the steam-hoist and progress at this depth is practically the same as was maintained in the upper part of the shaft.

CALIFORNIA

GRASS VALLEY, NEVADA COUNTY, PLACER COUNTY

GRASS VALLEY.—The Gold Lead Placer Mines, organized to work claims near Grass Valley, has filed articles of incorporation with the county clerk. The capital stock is 400,000 shares of the par value of $1 each. C. F. Lobecker, John T. Leatham, Oscar L. Coffin, John G.

Curts, and Olga Dausse are named as directors and incorporators.

Driving 800 ft. east from one of the lower levels in the Allison Ranch mine into the Berryman ground, where there is a good surface outcrop, has not yet encountered any ore. All work in a west drift for prospecting purposes has been suspended. Formerly one of the famous producers in this district, operations in search of new orebodies for the past few years have resulted in nothing but expense, over $700,000 having been spent for that purpose alone. The mine still has several millions to its credit, but each new company has ceased operations only after spending a large sum in an effort to locate a new body of ore. The present company has been very persistent, driving on each side of the shaft for long distances. A fine showing has recently been made in one of the veins on the Morande property west of Grass Valley. It is well defined and estimated to run $100 per ton. The owner, the State Highway Co., is reported to be continuing development with the purpose of encouraging some larger financial concern to take over its interests.

Nevada City.—At the Round Mountain Champion mine, bonded recently by a company headed by A. D. Foote, the old McCloud tunnel is being cleaned out. It is in 700 ft. and driving to tap the gravel channel has commenced. A new compressor was recently erected. Leonard Rockefeller and W. Buffington have a splendid showing on their quartz claim east of Nevada City. A 5-stamp mill is being erected and 300 tons of ore of an estimated value of $20 per ton is ready for crushing. The old Kate Hardy quartz mine on Oregon creek below Forest is being explored thoroughly. Twenty-five tons of supplies is on the ground for continuous operations throughout the winter. The main tunnel will be driven ahead, while the shaft within this tunnel will be sunk 400 ft. The mine is equipped with a small mill and is operated electrically. The mine has been a producer, and is believed to be on a continuation of the Tightner vein at Alleghany. The owner, W. M. Beggs, of San Jose, has bonded the property to some Boston people and E. C. Montgomery has been placed in charge.

Nevada County.—Good progress is being made in sinking the shaft in the Mariposa tunnel 600 ft. from the portal of the tunnel. The Apex and Bug quartz claims at Meadow Lake have been sold by the sheriff to E. Z. Cuneo, a judgment creditor against Harry D. Ramsay for $2007. The old Excelsior mine at Meadow Lake is being unwatered by Peter Bokay, who has equipped the property. It has not been operated since 1905 and developments on a large scale have been planned.

Placer County.—At the Canada Hill quartz mine every preparation has been made for winter work; all the buildings and yards have been protected by snow sheds. During the summer a test-run of 100 tons yielded $1500. The tunnel is to be driven ahead ensuring a greater working depth. No ore will be extracted until spring. The Rising Sun mine near Colfax is being unwatered by an electric hoist and pump, the latter having a capacity of 400 gallons per minute. Complete drainage will take from six weeks to two months. Messrs. Jeffrey and Day have a permit to carry on hydraulic mining at the old Lost Camp mine two miles from Blue Canyon and are making preparations for a trial run.

The Placer Chrome Co. has about completed its new mill near Rattlesnake bridge. At the present time the ore is being concentrated in an old mill running on one shift. Several carloads of concentrate were recently shipped East. Operations will be extended as the company intends to produce a high-grade concentrate. The Bear Barytes Co. has shipped several hundred-ton lots the past few months from Alta, although the mine is above Dutch Flat but a few miles. A small force of miners and a few teamsters have been employed. Bad roads have been a serious drawback.

Sierra County.—A new Gibson mill has just been completed at the Martini mine. It has an estimated capacity of 18 tons per day and is operated by a 5-hp. gas-engine. A recent test run yielded $10 per ton. The mine is at the head of Keystone ravine south of Sierra City and is owned by P. B. Loeffler and J. E. and Marion Westfall.

COLORADO

ACTIVITY AT LEADVILLE.—APEX LITIGATION AT RICO.

Leadville.—The high price of silver is bringing about greater activity than has been experienced in many years, and mining men generally concede that by next summer few shafts in the district will be idle. Properties are in demand and many have been taken over under lease and option, or, if a bond cannot be secured, under straight lease. The Long and Derry, a former rich silver-gold producer, has been inactive for some time. At present, operations are confined to cross-cutting to one of the mineralized porphyry dikes where ore is looked for on the contact. Henry Schrader is operating the Griffin by tunnel and is shipping ore weekly that averages 50 oz. of silver per ton. The lower tunnel is sub-leased and is being extended into the mill. It is now in about 1000 feet.

Rico.—The apex litigation of the Rico Consolidated Mining Co. and the Rico Argentine Mining Co. has been postponed until June 1920, and as the higher-grade orebodies in which both properties are interested is within the contested area, and tied up under an injunction, there will be very little production by the leading operators of the district until the case is settled. As the Marmatite M. & M. Co. is leasing the Rico Argentine property, the operations of this company are necessarily curtailed, although extensive operations on the Pro Patria and other properties in the district are under consideration. Howard M. Fields, president of the Marmatite M. & M. Co., is forming a company, to be known as the Marmatite Mining Co., which will operate the Emma mines, situated at Dunton, under a lease. The Emma formerly shipped gold-silver ore, and although it has been idle for a number of years, it has always been looked on as a good mine.

Paradox Valley.—Bulkeley Wells of the Smuggler

Union Mining Co. has assumed full control of the Radium company of Colorado. The company has a number of claims in the Long Park region, and is operating a series of mines, producing carnotite ore in large quantity. Two more mines were opened recently. Under the new regime the properties of the company will be developed to the utmost.

La Sal Mountains.—The Michigan Colorado Copper Co., operating on the Cashin group, has now definitely decided to erect a 100-ton mill at the mines. Power will be supplied by 100-hp. oil-burning engines, as the distance from the railroads and haulage difficulties favor oil as a fuel. The water resources of the district are being studied, and it is probable that water power will eventually supplant the oil-burning engines.

Ouray.—The Camp Bird Mines & Tunnel Co. is driving a series of raises from the new tunnel to the upper workings in order to permit development, and also to improve ventilation. Steel & MacDonald have abandoned their operations on the Calliope dumps for the season. The White Cloud Mining Co. is reported as having struck a rich vein of ore on the Money Queen.

La Plata.—Deep snow covers the ground at the higher elevations of this region, but development will continue on many of the properties of the district throughout the winter months. The Jumbo Mining Co. has made a few trial shipments of ore from the virgin ground opened up in the lime formation. Some assays show 70 oz. of silver per ton, and it is believed that the grade will increase as the work progresses. Mr. Little has transferred his interest in the lease on the Little La Plata to W. A. Becker, who plans to develop the mine into a producer for the coming season. A compressor has been erected and two cross-cut tunnels will be driven with the object of cutting the vein. The property is owned by the Wahl Brothers estate, and has been under lease to Messrs. Little and Carrigan, who worked over the dump during the past season, shipping ore that contained 12 to 15 oz. of silver, in addition to some gold.

A VIEW OF TELLURIDE, COLORADO

MICHIGAN

DEVELOPMENT AT THE SHAFT OF THE OLD MESNARD PROPERTY.

The Mohawk mine today has a larger force of underground workers than at any time within the past year. Calumet & Hecla added 56 miners to its working force in the past ten days.

No. 8 shaft, locally known as the old Mesnard property of the Quincy company, now is being sunk for the 71st level. This shaft today has close to five miles of underground openings in which work is being done. It is interesting to note too, that at the very bottom of the shaft the openings are in a quality of copper-bearing rock which is

ready better than the average for this branch of the Quincy company and above the average for the year 1918. The active lateral workings extend from the 54th on 16 different levels all the way down. The record of rock hoisted from this shaft for the past year will reach 350,000 tons if the present rate is maintained. This, of course, includes a substantial amount of mass and barrel copper in addition to the regular rock. Practically all of the stoping work has been confined to the east branch of the Pewabic formation. The only place where the Mesnard shaft has run out of high-grade ore is 2000 ft. north of the shaft. At that point, on several of the levels, the lode has pinched into poor ore. This condition is rather strange, for the upper levels showed rich formation to the north. In fact, the showing in the extensions toward the Mesnard territory in several of the upper levels of No. 8 shaft was so good that the Quincy company purchased this property on the showing, started the shaft and laid the foundation for a permanent hoisting-plant. Parts of the hoisting-plant were delivered five years ago and have not yet been set in place, no work being done at this No. 9 shaft, known locally as the Pontiac, in five years.

The return of old Michigan copper miners from Italy to Calumet offers an interesting commentary on the labor situation. When the War ended large numbers of the foreign miners returned to their native lands, the number returning from Calumet to Italy and Croatia being noticeably large. Apparently they did not find conditions there as much to their liking as they had expected, as the few who have returned to Michigan tell of the desire of those remaining in Italy to return to the United States.

NEVADA

OLYMPIC MILL BURNED.—EUREKA CROESUS CONTINUES SHIPMENTS.

MINA.—The 100-ton cyanide mill of the Olympic Mines Co. at Stewart Springs, in the gold-bearing porphyry belt north of the Simon mine, has been totally destroyed by fire. The mill was built in 1916 and at that time was valued at $70,000. It was constructed of wood and sheet-steel. The company was formed by Fred Siebert, a Reno, Nevada, mining engineer, and a number of San Francisco men are interested with him. The burned plant had been a steady producer of bullion.

LIDA.—The MacNamara mine, at Indian Gardens, 8 miles west of Lida, is being re-opened by the Allied Mining & Milling Co., in which Montana and Utah men are interested. The mine was discovered in 1880 and until 1903 it was worked by the locator. From that date it was tied up through an option and litigation until 1916, when it was taken over by Trepp and Heinecke of Lewistown, Montana, who, after prospecting the old workings, formed the Allied company early in 1919. Stopes show that a good production of lead silver ore was made in the early days and since 1916 three carloads of ore of a gross value of $5000 have been shipped. The mine is opened through three tunnels and a shaft, which show the vein to be from 6 to 15 ft. wide. The greatest vertical depth reached, 170 ft., is in a 330-ft. cross-cut tunnel, and a sample taken from a 10-ft. face in a drift at this depth gave an average of 35% lead, 15 oz. silver, and a trace of gold. The vein is in a well-defined alaskite-lime contact that can be traced on the surface for nearly 3000 ft. The company plans to prospect the vein through the shaft at a depth of 225 ft. to open the extension of the ore found in the tunnels, and if this work is successful, a 100-ton concentrator will be erected, as the distance of 33 miles to Goldfield, the nearest railroad point, makes shipping too expensive. Springs on the claims are estimated to have a flow of 90,000 gallons and there is a plentiful supply of nut-pine for timber.

CACTUS.—Joseph F. Nenzel, promoter of the Cactus Nevada Silver Mines Co., and Joseph Fynney, of the Boston real estate firm of Fynney & Cutter, which financed the company for $280,000, recently visited the mine. The main shaft, which is vertical and sunk 10 ft. from the vein, is now 200 ft. deep and it is planned to continue sinking to 600 ft., cross-cuts to be extended to the vein at 100-ft. intervals for further exploration. The principal work has been done at 100 ft., where drifts have opened ore for a distance of 300 feet.

DIVIDE.—The Detroit Divide has taken over the Carbonate mine in the New York Mt. district of San Bernardino county, California, 5 miles from the Nevada line and 2½ miles from the Salt Lake railroad. The Carbonate has been developed for three years, during which $30,000 has been spent in exploration work and in the construction of a 20-ton concentrator. A 3-drill air-compressor recently was put in place. The ore is a sulphide containing silver, copper, and lead, two-thirds of the metallic content being in silver. The lead content is small. The average width of the vein, where opened at a depth of 750 ft. by a tunnel, is 30 ft., the maximum width of the shipping ore being 44 ft. Two ore-shoots have been opened through the tunnel, one 50 and the other 95 ft. long. The formation in the district is grano-diorite, which is cut by dikes of porphyry. It is planned to extend the tunnel, shipping the best grade of ore, and erect a small flotation plant to treat the low-grade. The claims of the company in the Divide district are in the north-western part, adjoining the New York group.

EUREKA.—The Eureka Croesus continues shipments of rich ore at a rate of from 8 to 10 carloads weekly. New machinery, consisting of two 75-hp. semi-Diesel engines and an 8-drill air-compressor, has been bought by the Holly, on Adams hill, 1½ miles north of the Ruby hill mines. The winze from the 400-ft. level is nearing the 600-ft. point, where connection will be made with the shaft after the latter has been sunk from the present depth of 400 ft. Sinking the shaft to 700 ft. will be started after the new machinery has been erected. Shipments are being made from the winze. The Eureka Climax, adjoining the Diamond in the Prospect mountain part of the district, south of the town, is preparing to start work. This company, which was formed recently with officials of the Croesus heavily interested, owns the

Deadbroke, New Year, and Dagout mines, the latter having a production record of $100,000 to a depth of 100 ft. The principal development is through tunnels.

GOLDFIELD.—At 445 ft. from the shaft the west cross-cut from the shaft on the seventh level of the Florence is a short distance into the leased Combination No. 2 claim of the Development company. The vein it was expected to enter near this point has not yet been cut. The southeast cross-cut on this level is 307 ft. long. The driving of these cross-cuts, designed to explore far outside proved territory, is the only work being done by the Florence company.

OREGON

OPERATORS PREPARING TO RESUME GOLD MINING.

GRANTS PASS.—During the War period gold mining declined in Josephine county and the operators took up the mining of the War metals, and since the War the high cost of mining has prevented a general resumption of gold mining. Now, however, the operators are reaching a point where many of them, heavily encumbered with equipment, have no choice but to resume gold mining with present costs. Nearly all the old hydraulic placer mines in the county are ready for the season's run, and many operators are preparing to resume quartz mining. The early September rains were an impetus to the placer miners to prepare their properties in anticipation of an earlier season than usual, and the production of gold from this source the coming season promises to be the largest in the history of Josephine county.

HOLLAND.—W. R. Burner and associates of Holland, in the western part of Josephine county, have purchased the McCourt placer ground in that district and are employing a large force of men in developing the property. This ground for a number of years has been known to be rich, but on account of the depth and water the old-time equipment was useless. The new owners, however, are placing modern engines, pumps, hoists, etc., on this ground and by driving propose to be washing gravel by the first of the year. In this same region the old Hansen property is being prospected by Michigan people, by sinking shafts to bedrock with a view to eventually using a dredge. The ground averages 35 ft. to bedrock and if equipped with a dredge a hyro-electric power-plant will be erected near by on the Althouse.

PICKETT CREEK.—The Big Four placer mine 10 miles west-northwest of Grants Pass on Pickett creek, near the junction of Rogue river, which has been idle for several years, is ready to resume operations. This property is owned by M. J. Merrill, of Portland, Oregon, and covers 200 acres, chiefly on a bedrock of slate. The gravel ranges from 30 to 70 ft. in thickness, and is in part clearly stratified. The 14 ft. of red earthy sand and clay overburden is said to contain fine gold that can be saved, but the large pieces are in the bottom of the gravel. The lower 12 ft. of gravel contains well-rounded cobblestones, the largest being 6 inches in diameter. At the bottom a few boulders, generally slate, rest on bedrock, and from 2 to 4 ft. of the bottom gravel is partly cemented. The rim-rock rises abruptly and the slates are much crushed and faulted, forming a terrace on the north-west toward the creek. The old channel is 250 ft. in width and 30 ft. in depth below the slate-rim terrace, from which the gravel capping has in part been mined away. The water is supplied from Pickett creek at a head of 200 ft., two giants being operated for a large portion of the year.

Photo by Tom Gotthold

A VIEW OF THE FLORENCE MINE, GOLDFIELD, NEVADA

UTAH

GENERAL NEWS OF THE STATE.

SALT LAKE CITY.—The geophone sent by the U. S. Bureau of Mines for use by the crew of mine rescue car No. 11, in cases of underground accidents, where it is necessary to locate men or sounds at some distance underground, was called into service in the effort to rescue men entrapped in the Hunter Mining & Smelting Co.'s

mine at Mullan, Idaho. The men were rescued safely and the car has returned to Salt Lake City. This mine-rescue car, in charge of Richard V. Ageton, is one of the 11 cars now in use by the Bureau of Mines for training miners in first aid and mine rescue methods, and the use of oxygen-breathing apparatus. Each car has a crew that includes two experienced miners, a mining engineer in charge, and a surgeon.

ALTA.—By order of the Public Utilities Commission of Utah, issued November 15, the Little Cottonwood Transportation Co. is ordered to resume service on its line from Alta to Wasatch, in response to application of the South Hecla Mining Co., which declared it had ore awaiting transportation. The Commission held that the railroad company, as a common carrier, should give notice before discontinuing service, to the Commission, to the public, and to shippers. In the absence of such notice, the operation of the road should be resumed as soon as possible, the Commission orders, until such time as the Commission finds that weather conditions are prohibitive to further operation. The decision further stated: "The above would seem to be a reasonable and fair requirement in the treatment of the public. In this case, it is claimed by the defendants that the condition was precipitated by a sudden storm in the mountains which, of course, tended to relieve the railroad company from further operations while such conditions prevailed, if they were the cause of suspension of service. The shippers had reason to believe that service would continue until such time as notice would be given of discontinuance of operation." Had operations of the railroad been discontinued, it would have seriously affected the output of mines in this district.

Directors of the Cottonwood Metal Mining Co. have elected W. Mont Ferry, Mayor of Salt Lake City, as president; E. E. Watrous, vice-president; and S. J. Truman, secretary-treasurer. The main tunnel, now in 1071 ft., has encountered three fissures. It is expected that the Silver King fissure, in which good ore is generally found, will be cut within 400 or 500 feet.

BINGHAM.—Development work is continuing in the Montana-Bingham mine, according to C. G. Ballantyne, general manager. Shipments have been steadily maintained. About a month ago, in the Mayflower drift on the Montana-Bingham level, in the vein from which several shipments of high-grade copper ore have been made, a shoot of high-grade silver-lead ore was struck. After passing through this shoot and through a zone of iron sulphides, another larger and richer shoot was cut in the vein. For a distance of 15 ft., the top, bottom, and sides of the drift have been in ore, averaging from 8 to 16 oz. silver and from 20 to 27% lead. Former discoveries in this vein have been in the quartzite, while the last have been made in the limestone.

OPHIR.—The old Montana mine, to the north of the Ophir Hill property, will begin operations December 1. About 20 men will be employed there. The Diamond-Drilling Co. has completed the first of a series of holes on the old Walker property, which embraces the south side of the canyon and the underground rights of the town. The purpose of the drilling is to prove a theory advanced by several geologists that the same formation exists on the south side of the canyon as that encountered by the Ophir Hill. It is reported that the objective has been reached, and if this is the case, considerable activity can be expected from this company.

Lessees in Dry canyon are showing more activity than for some time past. It is expected that shipments during the current month will be considerably heavier than for any previous month this year. Shipments from the Ophir Hill property, the largest in this district, aggregate about 300 tons of high-grade silver-lead ore per week. The company is now sampling the old tailing-dump to ascertain the advisability of having it re-treated.

TOOELE.—It is reported that Jesse Knight, the well-known mining man of Provo, has become interested in the development of several groups of mining claims in Middle and Settlement canyons, and that active operations are now progressing. It is said that the Knight Investment Co. has taken an option on the Black Diamond group of claims in Middle Canyon from J. A. Kaufman, and on the Bingham-Midway group in Settlement canyon from O. E. Parsons and associates. There are now two shifts of four men each working on the Black Diamond group, driving a tunnel to connect with the Bingham-Midway group, from which Mr. Parsons has made several shipments of ore. Mr. Knight has had his engineers make an examination of the property, and they are of the opinion that the Bingham orebodies continue through the mountain and can be found on the Tooele side of the range, and it is thought that with extensive development work, large orebodies will be encountered.

PARK CITY.—Shipments from this district for the week ending November 22 totalled 1788 tons, of which the Silver King Coalition contributed 422 tons; the Ontario Silver, 346 tons; the Judge M. & S., 356 tons; the Daly-West, 287 tons; the old Daly, 161 tons; the Naildriver, 55 tons; and Three Kings, 25 tons.

EUREKA.—Ore shipments from the Tintic district for the week ending November 22 totalled 160 cars, being an increase of 20 over the previous week. The most noticeable increase was from the Tintic Standard property—from 18 cars for the week ending November 15 to 28 cars for the week ending November 22. With the increase in the price of silver to $1.34—a rise of 7c. in two days—mine operators of the district are optimistic in regard to the future of Tintic properties. At the same time, recent developments in the east side of the district indicate a bright future for the entire camp. Mines and number of carloads shipped during the week were as follows: Chief Consolidated, 41 cars; Tintic Standard, 28; Dragon Consolidated, 14; Iron Blossom, 13; Centennial Eureka, 12; Eagle and Blue Bell, 10; Colorado, 9; Mammoth, 9; Grand Central, 7; Swansea, 3; Gemini, 3; Ridge and Valley, 3; Bullion Beck, 2; Empire, 2; Victoria, 1; Alaska, 1; Oasis, 1; Sunbeam, 1; total, 160 cars.

WASHINGTON

INCORPORATION OF THE LA FLEUR MOUNTAIN COPPER CO.

FERRY COUNTY.—The La Fleur Mountain Copper Co. has been incorporated under the laws of the State of Washington, with Colville, Stevens county, the principal place of business. The directors are W. A. Acorn, president; I. J. Lasswell, secretary; E. J. Millberg, treasurer; George Wisner and J. L. Lasswell. The company owns the Comstock and Walla Walla groups, composed of the Copper Queen, Allis, Comstock, Copper Butte, Walla Walla, Le Roi, and four other fractional claims, all situated north-easterly and south-westerly on La Fleur mountain. They are traversed by two separate veins, known as the Walla Walla and Comstock veins. The Walla Walla vein cuts diagonally across the Walla Walla and Copper Queen claims and is reported to be 25 ft. wide. The Comstock vein traverses the same claims and is six feet wide. The ores of both veins contain gold, silver, copper, and platinum. The wider vein has a pay-shoot four feet wide, with an estimated average grade of about $70 per ton. The platinum content assays from $2 to $272 per ton. The only permanent workings are a 50-ft. shaft on the Walla Walla and a 37-ft. shaft on the Comstock vein. Out of a million $1 shares, 343,000 are in the treasury. Stock is being sold for development and purchase of machinery, and also to purchase a piece of ground adjoining the southern boundary of the Walla claim, owned as an Indian allotment. A shaft-house, bunk-house, and cook-house are among the improvements. The Great Northern and Spokane and British Columbia railway depots are situated about 1½ miles distant, with a downhill haul. An adit 2000 ft. long will tap the big vein at a depth of 1000 ft., and an 1800-ft. adit from the base of the mountain will cut it at a similar depth. The property has a good reputation.

GENERAL VIEW OF THE HIDDEN CREEK PLANT OF THE GRANBY COMPANY, OBSERVATORY INLET, B. C. FROM LEFT TO RIGHT: SMELTER, ENTRANCE TO 150 TUNNEL, NO. 2 CRUSHER PLANT, MINE BUILDINGS, AND ENTRANCE TO 385 TUNNEL.

BRITISH COLUMBIA

NEWS FROM SALMON RIVER AND CARIBOO.

SALMON RIVER.—On the Forty Nine property development is being continued energetically and is expected to be maintained throughout the winter. H. Howson, who is in charge, states that both the Occidental and the Forty Nine tunnels are being driven ahead, the former in shipping ore and the latter in a good concentrating grade. The Forty Nine tunnel was driven as a crosscut to tap the vein, and when the orebody was reached was continued as a drift. It is heading toward the high-grade ore which shows on the outcrop. Mr. Howson says that, if the transportation facilities were available, the property could be shipping now. The settlement is as comfortable as circumstances will permit, being laid out and built on modern plans, with baths, hot and cold water, and oil heaters, as well as the best of food and a good cook. There is also a completely equipped assay-office. As the first man went on the ground as late as July 1 last it is thought that a record of accomplishment has been made.

A large motor-sled ore-truck has arrived at Stewart for the Premier Gold Mining Co. This is expected to be the forerunner of a battery of the same, it being confidently anticipated that the truck will do the work for which it was purchased, namely, carry the ore over the winter trail from the mine to tidewater. It is likely that the new hauling device will be tried out about the middle of December, as the heavy snow, as a rule, does not come until about that time. It is the intention to erect a compressor at the mine and then use air-drills. An electric-light plant has been installed and the bunk-house, cook-house, compressor-building, and ore-sorting shed are to be lighted by electricity. The wires will be carried to the mine entrance.

Other properties which, according to a definite statement, will be active this winter are the Big Missouri, Mineral Hill, and Bush, while it is considered likely that the New Alaska will be developed to some extent.

CARIBOO.—John D. Galloway, Provincial engineer for the North-Eastern Mineral Survey District, has completed his summer's field work and reports the outlook in the Cariboo district to be most encouraging. Robert Brice, and associates, several of whom are connected with the Mining Corporation of Canada, have 70 men doing exploration work on the Proserpine lode claims, which they bonded in the summer. Two diamond-drills have been ordered, and these will be started as soon as they arrive. Work will be continued through the winter, as a heavy payment on the property falls due in the early

spring, and it is essential that a thorough exploration should be made before then. Two orebodies are known to run through the claims, and these consist of belts of quartz intercalated with quartzite, the quartz being the carrier of the precious metal. Should Mr. Brice's explorations prove satisfactory and the property be purchased, it will mean a great deal for the district, as it is proposed to put in a hydro-electric power-plant that will be able to supply other mines in the neighborhood. Considerable placer exploration has been done on Antler creek, and Mr. Moore and his associates have made arrangements to operate at least one large dredge next spring. The great need of the district is railway communication. Mr. Galloway says a comparatively easy route could be found between Barkerville and the Grand Trunk Pacific that would necessitate only about 60 miles of track. This route could be made to open up a new coal-field on the way.

ONTARIO

NEW DEVELOPMENT COMPANY.—MINES AT PORCUPINE STILL AFFECTED BY LABOR SHORTAGE.

A company under the name of Canadian-American Resources, Ltd., has been incorporated in Ontario with an authorized capital of $50,000,000, the largest capitalization ever authorized in this Province. Its object is to develop the natural resources of the continent, more especially in connection with mining and oil enterprises. It will have offices in both Toronto and New York. It is intended only to acquire properties of value and operate them by the company itself, which will carry on its own refining processes. The officers are as follows: President, Alexander Alexander, New York; vice-president, L. E. Denyes, Toronto; secretary, Dr. R. Gordon Bogart, Kingston, Ontario; treasurer, George B. Leighton, New York; directors, Col. Jacob Ruppert, New York; George B. Gifford, New York; and S. W. Jenckes, St. Catherines, Ontario.

BUTT TOWNSHIP.—Since the discovery of radium some weeks ago, there has been an influx of prospectors and many claims have been staked. It is too late in the season for active development, so that the question as to whether radium occurs in commercial quantities is hardly likely to be settled for some time, but capital is already seeking investment in the field. The Mining Corporation of Canada has secured an option on 74 acres, adjoining the discovery, from Rinaldo McConnell at $10,000, the first installment of which has been paid. Exploration of the property will be commenced as soon as possible.

PORCUPINE.—The gold-mining industry is still considerably handicapped by labor shortage and the leading mines are operating much below capacity. The expectation that the Hollinger Consolidated would resume the former dividend rate of 1% per month after January 1 now appears likely to be disappointed, as the management is inclined, so long as present conditions remain, to pursue a conservative policy. Arrangements are being made for the further exploration of the Moneta. Diamond drilling on the Keora has indicated some large orebodies. A mining plant has been purchased and development to a depth of 250 ft. will be undertaken. The Sovereign is diamond-drilling to tap an important vein discovered on the surface.

GOWGANDA.—The Trethewey has so far spent about $80,000 in the development of the Castle property, this amount having been made good by the high-grade ore already extracted. On the original Castle property a new vein 11 in. wide with patches of high-grade is being opened up, and on R. C. 101 the shaft is down 60 ft., at which point the vein is 5 in. wide and stated to carry 4000 oz. per ton. The growing importance of the Gowganda and Matachewan fields has resulted in a plan for the development of electric power at Indian Chutes on the Montreal river, the final survey and plans for which are in course of preparation. It is 20 miles distant from Gowganda and 15 miles from Matachewan. It is expected that the line will be ready for operation in about a year. Definite announcement has been made that the Canadian Light Railway Construction Co. will proceed with the construction of a narrow-gauge railroad next spring from Elk Lake to Gowganda, a distance of about 27 miles.

COBALT.—The Northern Customs Concentrator Co. has completed the purchase of a part of the Chamber-Ferland mine of the Alladin-Cobalt Co. The reason for such a sale by the Alladin is the fact that its Chambers-Ferland property is not equipped with a mill and cannot treat the low-grade ore, a substantial tonnage of which is estimated to contain about 12 oz. of silver per ton. The operation of the Silver Cliff property, under lease to the Northern Customs Co., is resulting in net profits of about $25,500 monthly. The enlarged case in connection with the Bailey-Cobalt litigation was heard in Osgoode Hall, Toronto, on November 19, decision being reserved. The control of the Buffalo mines has been sold to the Mining Corporation of Canada. A complete change in the directorate and the management is being made.

SONORA

ORGANIZATION OF THE BOSTON-MOCTEZUMA MINING CO.

The Boston-Moctezuma Mining Co. is being organized to take over from W. C. Humphrey and operate Guereguita mine, a silver property 20 miles south of Nacozari. The officials and directors are all Easterners, including Charles P. Vaughn, Ira Vaughn, Oliver Cutts of Philadelphia, and Lyman V. Banker of Newton, Massachusetts. The Guereguita was operated for several years by Mr. Humphrey and associates, large bodies of low-grade silver ore being developed. The average content of this orebody is said to be about $10 per ton, and it is expected to lend itself well to concentration. Several thousand feet of development has been done in tunnels. Engineers are said to have inspected the property recently with the idea of arranging a plan for transportation and for construction of a large concentrator on the property. A wagon-road connects the mine with Nacozari, the nearest rail point, which with a small expenditure can be put in good condition for use of motor trucks.

ARIZONA

Hackberry.—It is reported that the Hackberry mill will be closed down as soon as the remaining broken ore is treated. The shut-down will continue until further development on the lower levels and a new shaft are completed. High-grade silver ore will be stoped and shipped as usual.

Kingman.—It is expected that cross-cutting from the main shaft of the Buckeye to the Rural mine, to drain the latter, will be possible within thirty days. The old Buckeye shaft and workings are almost clear of water. Two cross-cuts are being driven from the main tunnel level of the Buckeye to prospect parallel veins.——M. B. Dudley and associates have put men to work on the IXL mine, situated 14 miles north of Kingman, to prepare for unwatering and sinking the shaft another 150 ft. G. D. Atlee is superintendent.——The Berkeley mine in the Cedar Valley mining district has been optioned to T. N. Stanton and C. L. Jones.

Miami.—It is expected that the new mill of the Miami Mining & Milling Co. at Doak will be in operation the first part of December. It is the intention of the management to erect a second section of 10 stamps, amalgamating plates, and tables as soon as the first section is operating satisfactorily. The main tunnel is now in 560 ft. and is to be driven another 500 ft. at which point it is expected to cut No. 5 vein. The tunnel has opened ore which assays $18 in gold besides considerable lead.

Prescott.—D. C. Cawley has sold his Centepede group of eight copper claims to an El Paso syndicate, a first payment of $2500 being made. Development work is to be commenced at once.

Ray.—Operations have been started at the Kile-Truman property. The shaft is to be sunk 100 ft. below the present tunnel level, which has exposed 5 to 25% copper ore. A winze is also to be sunk on the ore encountered in the tunnel to prove its extent.

Tucson.—October operations of the El Tiro property were of such success as to warrant the declaration of a dividend. Shipments of one 50-ton car per day were maintained during the month.

Winkelman.—The Gila Copper Sulphide Co. has been given the decision in its case of breach of contract with the A. S. & R. Co. A year ago the A. S. & R. Co. refused to accept any further ore from the Gila Copper Sulphide Co., claiming that all ore purchased was done at a loss. A restraining order was obtained pending a decision. During the past year the Gila Copper Sulphide Co.'s operations were sufficiently successful to enable them to make a profit and raise enough money to pay off the bond holders, who threatened foreclosure.

CALIFORNIA

Brandy City.—The Brandy City Hydraulic Mines Co. has completed preparations for extensive mining and is awaiting the wet season. Twenty-five men are employed under the management of Warren Godfrey. Extensive areas of proved rich ground are ready for the giants. Debris will be impounded by the restraining dam constructed on North Yuba river last summer.

Piedra.—G. S. Lane and Henry Nolte have taken a lease on the Ward magnesite mine near Piedra. The product will be delivered by truck to the kiln at Piedra, which is to be operated by Sinclair brothers.

Yreka. S. H. Gillette has sold his placer holding at Garvey's bar on the Klamath river to J. B. Johnson of Benicia. The property has been worked several years and produced considerable gold. The new owner plans operations along broader lines.

IDAHO

Coeur d'Alene. The Federal Mining & Smelting Co. asks for a redress of $6,000,000 from the Hecla Mining Co. for ore mined in the Russell claim and Russell vein of the Federal company, according to a suit filed in the United States court at Coeur d'Alene. The Federal also asks that the Hecla company be required to set forth its claims that they may be determined by the court, that the Hecla be enjoined from asserting any claim whatever to the Russell lode in which the vein is said to apex, and that the Hecla be restrained from further penetration of the vein, and be required to give an accounting of the ore already extracted, as well as be perpetually enjoined from further penetration of the vein.

The Hecla Mining Co. has declared its regular quarterly dividend of $150,000. The declaration is at the rate of 10c. per share on an issue of 1,000,000 shares. Payment will be made on December 28 to stockholders of record on December 1. This payment will raise the grand total of disbursements to $7,855,000, of which $600,000 will have been disbursed in the current year. The surplus has been estimated unofficially at $2,000,000, including the sum subject to income tax.

Wardner.—Concerning the resumption of work by the Wardner Leasing Co., under the town of Wardner, J. D. Owens, secretary, says: "We will first unwater the shaft, which is down about 200 ft., and then will extend the drift from the bottom of the shaft, which is about 200 ft. long. We believe we will catch the lode that crosses Milo creek, on the ground covered by our lease, and when this lode is reached we expect to find a large body of ore."

The Caledonia Mining Co. has declared its regular monthly dividend of $26,050. This is at the rate of a cent a share on the issue of 2,605,000 shares. Payment will be made on December 5. The forthcoming disbursement will increase the total payments for the year to $312,400 and the grand total to $3,985,650.

MONTANA

Mineral County.—Several mining properties are being opened in Mineral county and just over the divide in the St. Joe and Clearwater districts in Idaho, and throughout the district there are signs of a return of at least a portion of the old-time activity.

NEVADA

Fallon.—L. W. Grehore, of the Fallon Oil Field District Association, has issued an official statement denouncing reports that oil had been discovered in the field. The story was circulated by promoters having headquarters at Reno, who declared that one well was flowing three to ten barrels daily, and another was spouting oil and gas. The official

statement is to the effect that no oil has been found anywhere in the field, aside from seepage, and that such reports are certain to handicap legitimate exploration.

Rochester.—Rochester Mines Co. has signed an agreement with employees providing for payment of a bonus with each advance of silver above $1.20 per ounce. The bonus ranges from 25 to 50c. per day, based on price fluctuations of silver for each month. With silver at, or below, $1.20 the regular wage scale of $5.50 for machine men and $5 for miners prevails. The agreement is effective until May 1, 1920. Conditions in the mine are reported satisfactory, with the improved mill effecting an excellent metal recovery. C. A. Bennett is general superintendent.

OREGON

Medford.—The Bolen Creek Mining Co., in which a number of Medford people are interested, has been organized under the laws of Arizona and capitalized at $150,000. The office of the company is in Medford with Porter J. Neff as attorney-in-fact for the concern. Its gold placer mine is located on Sucker creek in the Holland district of Josephine county, 30 miles west of Medford. The mine is now being equipped for operation.

WASHINGTON

Chewelah.—The United Silver Copper mine is now producing 250 tons per day of milling ore, from which 6 to 8 cars of flotation concentrate and one car of high-grade table concentrate is shipped monthly. In addition from 50 to 150 tons per month of high-grade ore is shipped direct. The mill consists essentially of tables and a flotation unit. It has recently been remodeled and is now doing good work. The mine is 1400 ft. deep, and is opened by a cross-cut 4200 ft. long. The ore is described as being a "big little vein", narrow but persistent. Gasoline haulage is used, the ore being hauled in trains of from eight to ten 1½-ton cars. Development at present is opening ground in the upper levels that was left behind when the mine was first opened. This ground is expected to produce good milling ore. Oscar Lachmund is general manager.

BRITISH COLUMBIA

Trail.—Ore receipts at the smelter of the Consolidated Mining & Smelting Co. were 5593 tons for the week ended November 14. This is a heavy increase over the week before, when the total was 4235 tons. The total for the year is now 285,258 tons.

Receipts for the week and to date this year are as follows:

	Week	Year
Alamo mill, Alamo	54	347
Bluebell, Riondel	92	1,357
Cork Province, Zwicky	51	194
Consolidated Mines, Cline, Wash.	41	591
Eureka, Nelson	36	239
Echo, Silverton	206	488
Emma, Coltern	1507	15,195
Iron Mask, Kamloops	160	2,883
Lone, Rossland	266	12,256
Molly Gibson, Kittos	169	873
Mandy, Le Pas, Manitoba	153	8,244
Mountain Chief, Renata	178	323
North Star, Kimberley	467	6,551
Providence, Greenwood	29	258
Rossland properties, (Consolidated Co.)		
Rossland	1336	63,660
Ruth, Ainsworth	167	272
Scarlon, Cline, Washington	28	234
Rambler Cariboo, Rambler	194	462
Standard, Silverton	558	1,274
Sullivan (zinc), Kimberley	[illegible]	111,339
Whitewater, Retallack	63	183

Personal

The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

Arthur Winslow is at Telluride.

H. R. Plate has returned to San Francisco from New York.

H. A. Megraw passed through San Francisco on his way to Arizona.

J. I. Brown has moved from Thane, Alaska, to Seattle, Washington.

H. R. Wagner, of the A. S. & R. Co., has returned to New York from Mexico.

A. W. Clapp, formerly of Pasadena, California, is now at Tonopah, Nevada.

E. R. Abadie is superintendent of the Blue Mountain gold mine at White River, California.

E. H. Leslie, representative of the 'M. & S. P.' at Chicago, is in San Francisco this week-end.

Thomas J. Ryder has given up his Mexico City office, and is now at 65 Broadway, New York.

K. A. Hinde passed through San Francisco on his return from Ekibastus, in Siberia, to London.

Charles Boeking, assistant manager for the Butte & Superior Mining Co., has been in New York.

Charles E. Prior is assistant manager for the Exploration Syndicate No. 2, at Cherry Creek, Nevada.

Frank Daniels, of Pasadena, is on his way home after a mine examination in Mineral county, Nevada.

I. B. Fabrikant, recently with the Mount Lyell company, has arrived in San Francisco from Melbourne.

H. S. Lyne has left Salmo, B. C., and will visit Palo Alto, California, before proceeding to South America.

W. M. Summerhayes, manager for the Bluestone Mining & Smelting Co., at Mason, Nevada, is at the Palace hotel.

Kent Roberts has resigned as superintendent for the Hillside Fluor Spar Mines, at Elizabethtown, Illinois, and is now at Chicago.

Will H. Coghill, of the U. S. Bureau of Mines, has been transferred from the Experiment Station at Seattle to that at Golden, Colorado.

Frank O. Jasmer is with the Companias del Agwi, of Tampico, Mexico, constructing a sea-loading crude-oil pumping-station in the State of Vera Cruz.

J. D. Shilling has become general superintendent of mines for the Utah Copper Co., and his son, **J. D. Shilling, Jr.**, becomes superintendent of mines for the company.

Horace V. Winchell, president of the American Institute of Mining & Metallurgical Engineers, will address the San Francisco section on Tuesday evening, December 22.

Thomas Varley, metallurgist in charge of the U. S. Experiment Station at the University of Utah, has returned to Salt Lake City from a short trip to Moscow, Idaho, and Butte, Montana.

Thomas H. Tulloch has resigned as general superintendent for the Chestatee Pyrites & Chemical Corporation to accept a position with the American Venture & Mines Corporation at Thomson, Georgia.

R. G. Knickerbocker has been appointed by the Messina Transvaal Development Co., Ltd., to supervise the erection and direct the operation of its powdered-coal reverberatory smelting and copper-refining furnaces at Messina, in South Africa.

W. H. Freeland, formerly manager for the Ducktown Sulphur, Copper & Iron Co., Ltd., died in St. Luke's hospital, San Francisco, on November 22.

THE METAL MARKET

METAL PRICES

San Francisco, December 2

Aluminum dust, cents per pound	65
Antimony, cents per pound	9.50
Copper, electrolytic, cents per pound	18.50
Lead, pig, cents per pound	7.00—8.00
Platinum, pure, per ounce	$150
Platinum, 10% iridium, per ounce	$180
Quicksilver, per flask of 75 lb	$95
Spelter, cents per pound	9.50
Zinc dust, cents per pound	12.50—15.00

EASTERN METAL MARKET

(By wire from New York)

December 2.—Copper is weak. Lead is quiet and firm. Zinc is quiet and strong.

SILVER

Below are given official or ticker quotations, in cents per ounce of silver 999 fine. From April 23, 1918, the United States government paid $1 per ounce for all silver purchased by it, fixing a maximum of $1.01½ on August 15, 1918, and will continue to pay $1 until the quantity specified under the Act is purchased, probably extending over several years. On May 5, 1919, all restrictions on the metal were removed, resulting in fluctuations. During the restricted period, the British government fixed the maximum price five times, the last being on March 25, 1919, on account of the low rate of sterling exchange, but removed all restrictions on May 10. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the normal rate of exchange.

		New York cents	London pence
Nov.	26	137.50	75.37
	27 Holiday		
	28	135.00	72.62
	29	129.00	72.62
	30 Sunday		
Dec.	1	129.00	73.12
	2	129.50	73.75

Average week ending	Cents	Pence
Oct. 21	117.95	63.98
" 28	119.37	64.45
Nov. 4	122.20	66.16
" 11	124.32	67.22
" 18	125.73	68.81
" 25	131.93	73.46
Dec. 2	132.00	73.50

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	75.14	88.72	101.12	July	78.92	99.62	106.36
Feb.	77.54	85.79	101.12	Aug.	85.40	100.31	111.35
Mch.	74.13	88.11	101.12	Sept.	100.73	101.12	113.92
Apr.	72.51	95.35	101.12	Oct.	87.38	101.12	110.10
May	74.61	99.50	107.23	Nov.	85.97	101.12	127.57
June	76.44	99.50	110.50	Dec.	85.97	101.12	....

COPPER

Prices of electrolytic in New York, in cents per pound.

Date		
Nov.	28	19.00
	27 Holiday	
	28	18.75
	29	18.50
	30 Sunday	
Dec.	1	18.25
	2	18.25

Average week ending	
Oct. 21	21.87
" 28	21.75
Nov. 4	21.37
" 11	21.10
" 18	21.36
" 25	19.48
Dec. 2	18.55

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	29.53	23.50	20.43	July	29.67	26.00	20.82
Feb.	34.57	23.50	17.34	Aug.	27.42	26.00	22.51
Mch.	36.00	23.50	15.05	Sept.	25.11	26.00	22.10
Apr.	33.13	23.50	15.23	Oct.	23.50	26.00	21.66
May	31.89	23.50	15.01	Nov.	23.50	26.00	20.45
June	32.57	23.50	17.53	Dec.	23.50	26.00	....

LEAD

Lead is quoted in cents per pound, New York delivery.

Date		
Nov.	26	6.75
	27 Holiday	
	28	6.75
	29	6.75
	30 Sunday	
Dec.	1	6.75
	2	6.75

Average week ending	
Oct. 21	6.43
28	6.66
Nov. 4	6.75
11	6.75
18	6.80
25	6.75
Dec. 2	6.75

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	7.64	6.85	5.60	July	10.03	8.03	5.53
Feb.	9.10	7.07	5.13	Aug.	10.75	8.05	5.78
Mch.	10.07	7.36	5.24	Sept.	9.07	8.05	6.02
Apr.	9.38	6.99	5.05	Oct.	6.97	8.05	6.40
May	10.29	6.88	5.04	Nov.	6.38	8.05	6.76
June	11.74	7.59	5.32	Dec.	6.49	6.90	....

TIN

Prices in New York, in cents per pound:

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	44.10	85.13	71.50	July	62.60	93.00	70.11
Feb.	51.47	85.00	72.44	Aug.	62.53	91.33	62.20
Mch.	54.27	85.00	72.50	Sept.	61.54	80.40	55.79
Apr.	55.63	88.53	72.50	Oct.	62.24	78.82	54.82
May	63.21	100.01	72.50	Nov.	74.18	73.67	54.17
June	61.93	91.00	71.83	Dec.	85.00	71.52	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound:

Date		
Nov.	26	8.20
	27 Holiday	
	28	8.25
	29	8.30
	30 Sunday	
Dec.	1	8.35
	2	8.45

Average week ending	
Oct. 21	7.89
28	8.10
Nov. 4	7.9
11	7.97
18	8.28
25	8.16
Dec. "	8.31

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	9.75	7.78	7.44	July	8.98	8.72	7.78
Feb.	10.45	7.97	6.51	Aug.	8.58	8.78	7.81
Mch.	10.78	7.67	6.53	Sept.	8.33	9.58	7.57
Apr.	10.20	7.04	6.49	Oct.	8.32	9.11	7.82
May	9.41	7.92	6.43	Nov.	7.76	8.75	8.17
June	9.63	7.92	6.91	Dec.	7.84	8.49	..

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. Prices, in dollars per flask of 75 pounds:

Date	
Nov. 4	80.00
" 10	80.00
" 18	80.00
" 25	75.00
Dec. 2	95.00

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	81.00	128.06	103.75	July	102.00	120.00	100.00
Feb.	126.25	118.00	90.00	Aug.	115.00	120.00	103.00
Mch.	113.75	112.00	72.80	Sept.	112.00	120.00	102.60
Apr.	114.50	115.00	73.12	Oct.	102.00	120.00	86.00
May	104.00	110.00	84.80	Nov.	102.50	120.00	78.00
June	85.00	112.00	94.40	Dec.	117.42	115.00	....

MONEY AND EXCHANGE

Foreign exchange continues to be demoralized, the pound sterling hovering around the low dollar mark with frequent recessions below that level. The rejection of the Treaty has received a good deal of emphasis as one of the primary causes for this, but much doubt is expressed by many financial critics as to the soundness of that idea. The obstacles in the way of the stabilization of foreign exchange are so great that, although the ratification of the Treaty would undoubtedly be reflected by more favorable rates, it is unlikely that it would cause the improvement apparently expected by many people. The latest United Kingdom offering in this country was not very well accepted, which does not forecast great success in floating other foreign loans here.

Although it is not generally believed that the so-called Davison plan for extending credits to European countries has been abandoned, bankers at the moment are patiently waiting for the atmosphere at Washington to clear before any further steps can be taken in the matter. Some bankers believe no plan for foreign financing will be successful, even if taken under the Edge bill when passed, unless the United States government lends its active support in one shape or another. But the Washington authorities take an entirely different view, as appears from the following extract from the November issue of the federal reserve bulletin:

"During October there has been further agitation in behalf of Government support of export financing. Two arguments are advanced in support of Government participation or maintenance of this kind of financing. That otherwise the financing will not be done and that consequently meritorious requirements whose satisfaction is necessary in order to bring about the restoration of political order will not be made; and that unless such provision is made other countries will take advantage of our hesitation and will occupy the foreign market to the exclusion of the American exporter.

"These two arguments are mutually self-destructive, since the first is based on the belief that unless the United States supplies the credit necessary to facilitate the movement of goods abroad, it will not be furnished, while the latter is confessedly founded upon the view that other countries may be in position to anticipate our action in the maintenance of the sale of our goods abroad. In any event, it is the declared policy of Congress no longer to accept the task involved in foreign financing, but to pass this work to private hands. That not a few representative American financiers believe this policy to be wise has been indicated by the expression of opinion at the international conference meeting at Atlantic City during the week ended October 25."

In announcing the offering of two new 4¼% Treasury certificate issues, one of them in anticipation of taxes, Secretary of the Treasurer Glass says: "In my letter of September 8, I stated that while it could not be said definitely when semi-monthly issues of loan certificates would be resumed such issues would certainly not be resumed before October 15. Though most factors in the general situation since then have been adverse, the position of the Treasury has developed more favorably than there seemed any reason to hope. The great success of the issue of the tax certificates then announced, the reduction in current expenditures, and the increase of receipts, notably from sales of war materials and supplies, have made it possible to avoid until now the resumption of issue of certificates."

Quotations on December 2 are as follows:

Sterling	Cable	3.98¾
	Demand	3.96
France	Cable	9.98
	Demand	10.00
Lire	Demand	12.35
Marks		2.40

Eastern Metal Market

New York, November 26.

The markets are generally quiet and featureless, with prices in most cases easy to firm.

Copper prices have further weakened.

The tin market has been quite active, buying for future shipment predominating.

Dullness characterizes the lead market, with prices firm.

Buying of zinc has been light, but the market is fairly firm.

Antimony is unchanged.

IRON AND STEEL

The market is under the influence of the efforts of manufacturing consumers to provide against the scarcity of steel that is in sight for part of 1920, and of the policy of leading producers to keep from overselling and to hold prices in check. Despite the coal strike situation the large steel companies have maintained output and there have been some further gains from the return of strikers to work. Loss of output, due to the steel strike, is estimated at 2,500,000 to 3,000,000 tons of finished material. Railroad buying is looming up to compete with regular consumption, and the demand for steel plates for shipbuilding is growing. Structural business also is expanding. Premiums are offered for plates, bars, and particularly sheets, and pig-iron continues to advance. Even the scrap market is active and prices are soaring.

COPPER

Fairly active competition for such little business as is offered has further depressed the market. Some of the large producers, as well as outside interests, have freely competed for the business going, with the result that electrolytic copper can be bought anywhere from 19 to 19.25c., New York, with Lake copper largely nominal at 19.50 to 19.75c., New York, both for delivery this year. An interesting estimate places the average month's production of refined copper this year at 125,000,000 lb. per month, with exports averaging 43,500,000 lb. This would leave for domestic consumption about 81,500,000 lb. each month. It is believed, however, that consumption here has not averaged over 70,000,000 lb. per month. This would show that 100,000,000 lb. has been added to surplus stocks since January 1. This will explain to some extent why prices have fallen and continue to turn that way. Late reports are that electrolytic copper has sold down to 18.75c. today for early delivery.

TIN

Early last week the market was quiet, but toward the end of the week there were liberal sales, mostly for future shipment—November, December, January, and February—from the Far East. In all about 1000 tons was booked, at prices ranging from 52.12½ to 52.75c. Since then the market has advanced, due to a rapid rise at London and also to the improvement in exchange. The London advance is ascribed partly to the heavy buying here. The last quotations here yesterday were 54c. for future shipment from England or from the Straits, with spot delivery at 54 to 54.25c. Not much prompt metal was sold, but consumers and dealers were the principal buyers last week for future shipment. Tin arrivals thus far this month have been 3305 tons, of which 1000 tons came in at Pacific ports. The quantity afloat is 3615 tons. The last quotation for spot Straits at London was £292 10s. per ton.

LEAD

The market has been quiet. There appears to be no anxiety to buy and business has been light. A few resale lots have been offered at New York at 6.75c. The leading interest continues to quote 6.75c., New York, and 6.50c., St. Louis. The outside market at St. Louis is slightly higher than that of the Trust. We quote the market at 6.75c., New York, and 6.55c., St. Louis. Underlying conditions are regarded by the trade as favorable and satisfactory.

ZINC

This market has been largely influenced by the foreign situation. Because of an advance in the price of zinc in London and because sterling exchange also improved, the quotation for prime Western here also rose this week. Today this grade is quoted at 7.85c., St., Louis, or 8.20c., New York, for this year's delivery. Demand, both foreign and domestic, is light. The decline in prices the last few days did not bring out much buying, indicating that galvanizers and others are fairly well supplied under present conditions.

ANTIMONY

The conditions are unchanged and the metal is quoted at 9.25c., New York, duty paid, for wholesale lots for early delivery.

ALUMINUM

Virgin metal, 98 to 99% pure, is unchanged at 32 to 33c., New York, for wholesale lots for early delivery.

ORES

Tungsten: The market is lifeless and prices are nominal at $7 to $10 per unit in regular concentrates. Some Chinese ore, about 65 tons, has been offered at the Pacific Coast at $7 per unit. Ferro-tungsten is probably obtainable around $1 to $1.25 per pound of contained tungsten, but no test of prices is reported.

Molybdenum: A little more inquiry has appeared, but the market as a whole is quiet with quotations nominal at 75c. per pound of MoS_2 in 90% concentrates.

Manganese: Quotations are nominal at around 50c. per unit. Imports in September were 19,601 tons, making the total to October 1 this year 269,411 tons. This compares with 382,382 tons to October 1, 1917, and 494,633 tons to October 1, 1918. Brazil furnished 203,132 tons of the 1919 imports to October 1.

Manganese-Iron Alloys: American producers of ferromanganese have advanced their quotation from $110 to $120 per ton, delivered. A substantial business has been booked at $110 and there are liberal inquiries for delivery in 1920, which it is expected will be booked at $120. British makers are still out of the market. Business in spiegeleisen is brisk, with sales up to 6000 tons reported, mostly for domestic consumption and with sizeable inquiries still before the market for foreign and domestic use. Germany has been obtaining American spiegeleisen through Holland. The domestic market is $36 to $45, furnace, depending on the seller.

There has been a fair volume of copper business done during the past few weeks, but some of it has been handled in an unusual manner. The business booked has not been entirely to consumers, but to and through smaller agencies and second hands, indicating that the metal sold to dealers must eventually come on the market again. The policy adopted by some of the larger producing interests has been to lighten ship, and where consumers were not interested to utilize brokers and other agencies. Sales into actual consumption have been moderate.

Book Reviews

The Condensed Chemical Dictionary. Compiled and edited by the editorial staff of the 'Chemical Engineering Catalog'. F. M. Turner, Jr., technical editor; D. D. Berolzheimer, W. P. Cutter, John Helfrich, assistant editors. Pp. 525. The Chemical Catalog Co., New York. For sale by 'Mining and Scientific Press'. Library buckram, price $5. Flexible leather-cloth covers, thumb index, $6.

The growth of the chemical industries and their increasing importance in affairs has brought into our daily language many names and terms but dimly understood by those not trained in chemistry. Such men as exporters and importers, purchasing agents, lawyers, and insurance companies have frequent need for detailed information regarding chemicals and chemical products. This book was designed largely to meet the needs of these non-technical men, and yet even the professional chemist could hardly hope to know much of the detailed information that is contained in it. The idea was to furnish, in a compact form and so arranged as to be quickly found, the outstanding facts regarding the chemicals and chemical materials ordinarily met with in commerce. With this end in view, such information as fire hazard, railroad shipping regulations, containers, and grades manufactured, has been included. Methods of manufacture and purification are briefly stated, although it is obvious that within the limits of a dictionary such information must be merely an outline and cannot be treated in detail. Uses, solubilities, constants (specific gravity, melting-point, boiling-point, etc.), color, ordinary properties, and chemical formula are given for each item. Although we fully appreciate the difficulties that would have attended an enlargement of the scope of the work to include anything so unstable as prices, yet we believe that a book compiled largely for the use of those interested in chemicals from the commercial view-point would have gained by the inclusion of such information, however broad the limits of such prices would need to be. Many of those who find the book useful will undoubtedly be puzzled to judge whether a chemical sells for approximately $10 per ounce or 5c. per pound. With that reservation, the book is excellent. The arrangement is alphabetical with liberal cross-references, and any required item can be quickly and easily found. There is ample space on each page for marginal notes by the user. The work closes with a series of convenient tables. We can commend this book to all those who require quick access to the salient facts regarding the large number of chemicals used in manufacturing and laboratory work. Although it is addressed to and will find its greatest use in the hands of the non-technical man, it will undoubtedly be of value also to the professional chemist, who will be able thus to look up quickly much information that he requires without spending the time needed to consult his more cumbersome works of reference.

The Physical Chemistry of the Metals. By Rudolph Schenck. Translated and annotated by Reginald Scott Dean. Pp. 239 + viii, ill., index. John Wiley & Sons, New York. For sale by 'Mining and Scientfic Press. Price, $3.

This book is the outgrowth of a series of lectures by the author, who is professor of physical chemistry in the Technischen Hochschule at Aachen, delivered in 1907 before the engineers of the Rheinish industrial district. The object of the lectures was to demonstrate the use of chemical statics and the underlying reasons for many smelting operations and metallurgical processes. In the German edition, which was published in 1908, especial care was taken to develop the principles of equilibrium. Many hitherto unpublished facts were incorporated, including the equilibrium between the various components of steel, the quantitative determination of amorphous carbon and graphite, and the investigation of the sulphatizing roast. In this first English edition the translator, who is research metallurgist to the American Zinc, Lead & Smelting Co., has changed the book from lecture to text-book form and brought it thoroughly up to date. Many additions have been made to the text and all numerical data revised according to the latest accepted values. Although this work makes no pretences to being an exhaustive treatise, it goes into the various branches with a thoroughness sufficient for the use of any except the advanced research specialist. It will be especially valuable to metallurgists, metallographers, and students in these and allied subjects. Exposition of the electron theory has been omitted as hardly warranted by the scope of the work. We find this book a clear and orderly presentation of a subject that is too little understood by engineers in general, and believe that many would have their understanding of metallurgy and associated fields increased to a valuable extent by a careful reading. The chapters on alloys are particularly good, and are illustrated with many illuminating diagrams and micro-photographs. The only fault we have to find is with the index, which is a mere skeleton, and not at all up to the rest of the work. This can be an exasperating defect when a book is used for reference.

Opportunities in Chemistry. By Ellwood Hendrick. Pp. 102 + x. Harper & Bros., New York. For sale by 'Mining and Scientific Press'. Price, $1.

This little book is an attempt, by one well qualified to undertake the task, to explain in simple and attractive language the broad field of modern chemistry. It is written for those who have no previous knowledge of the subject, but who would like to know something of what chemistry is and how it affects us in our daily life, whether their object is merely the gratification of a simple curiosity, or a search for guidance in deciding as to the advisability of chemistry as a career. With this in view, the author discusses briefly several of the typical industries of modern times, and the manner in which research chemistry has been applied to their study in order to simplify processes and improve results. Agriculture and steel-making, what fuel is, and why soap cleanses, each comes in for its share of entertaining and instructive comment. And although the book is not intended for those versed in chemistry, yet the attractive and sometimes whimsical method of outlining the many fields into which this useful science is poking its inquisitive fingers can hardly fail to be of interest to anybody. For the young man hesitating on the choice of a career it should have many valuable hints, and for the business man who wishes to increase his general knowledge it will provide the means of passing a pleasant hour. At the end are listed three or four books that offer further and more detailed study to the reader whose interest has been aroused.

Antimony: Its Chemistry, Metallurgy, Uses, Etc. By Chung Yu Wang, M.A., B.Sc. Second Edition. Pp. 217 + x, with numerous illustrations and index. Charles Griffin & Co., Ltd., London. For sale by 'Mining and Scientific Press'. Price, $5.

This belated reprint of the standard treatise on antimony will be welcomed by many who, since the exhaustion of the first edition, have found themselves unable to purchase copies. It is the only treatise on antimony of which we are aware; the treatment, as many already know, is exhaustive and the style concise and lucid. In this many whose native language is English might obtain a lesson from the brilliant Chinese author. Each chapter is followed by an exceptionally complete bibliography, the number of languages represented in the periodicals testifying to the difficulty of collect-

ing so much scattered information on antimony into one orderly volume. The metallurgy of antimony receives the most space, 80 pages being devoted to this important branch of the subject. This chapter is profusely illustrated with drawings of furnaces and retorts. Antimony preparations and their uses are also treated at length, including many tabulations of alloys and methods of preparing them. Other phases that receive adequate attention are the history of antimony, its chemistry and mineralogy, the geological occurrence of the ores, the analysis of antimony compounds, the production and valuation of antimony ore, and the principal mines and smelting works of antimony. This book is indispensable to anyone who wishes to acquire a thorough knowledge of antimony and its compounds, or who wishes an authoritative work of reference. In its present form it is not, strictly speaking, a second edition, as it has not been revised, but a reprint of the first edition, made necessary at this time by the growing demand, which could not be satisfied during the War.

Recent Publications

Potash Salts. Excerpts from Monthly Reports on Minerals Investigations of the U. S. Bureau of Mines, for August, 1919. P. 1.

Notes on the Petroleum Situation. Excerpts from Monthly Reports on Minerals Investigations of the U. S. Bureau of Mines, for August, 1919. Pp. 2.

Coal. Excerpts from Monthly Reports on Minerals Investigations of the U. S. Bureau of Mines, for August, 1919. Pp. 4.

Major Metals. Excerpts from Monthly Reports on Minerals Investigations of the U. S. Bureau of Mines, for August, 1919. Pp. 9.

Conditions in the Missouri-Kansas-Oklahoma Zinc and Lead District. By W. E. Henry. U. S. Bureau of Mines, 1919. Pp. 14, map.

Recovery of Zinc from Low-Grade and Complex Ores. By D. A. Lyon and O. C. Ralston. Bull. 168, U. S. Bureau of Mines, 1919. Pp. 145.

War Minerals, Nitrogen Fixation, and Production of Sodium Cyanide. By Van. H. Manning. Bull. 178-B, U. S. Bureau of Mines, 1919. Pp. 61.

Burning Steam Sizes of Anthracite With or Without Admixture of Soft Coal, U. S. Fuel Administration. Technical Paper 220, U. S. Bureau of Mines, 1919. Pp. 8.

Method of Administering Leases of Iron-Ore Deposits Belonging to the State of Minnesota. By J. R. Finlay. Technical Paper 222, U. S. Bureau of Mines, 1919. Pp. 40.

The Vapor Pressure of Lead Chloride. By E. D. Eastman and L. H. Duschak. Technical Paper 225, U. S. Bureau of Mines, 1919. Pp. 16, plates.

The Oil Shales of Northwestern Colorado. Bull. 8, Colorado Bureau of Mines, Denver, Colo., 1919. Pp. 51, ill., maps, index.

Zinc Industry in Belgium. By March F. Chase. Minerals Investigations Series No. 18, U. S. Bureau of Mines, 1919. Pp. 8.

Preparation of Manganese Ore. By W. R. Crane. Minerals Investigations Series, No. 17, U. S. Bureau of Mines, 1919. Pp. 16.

The Potash Industry of the United States and Its Possibilities for Future Production. By Arthur E. Wells. Minerals Investigations, Preliminary Report, U. S. Bureau of Mines, 1919. Pp. 20.

Uses of Manganese Other Than for Steel Making. By W. C. Phalen. Minerals Investigations Series, No. 18, U. S. Bureau of Mines, 1919. Pp. 12.

Cost of Producing Ferro-Grade Manganese Ores. By C. M. Weld and W. R. Crane. Minerals Investigations Series, No. 13, U. S. Bureau of Mines, 1919. Pp. 22.

Gold. By John E. Orchard. Political and Commercial Control of the Mineral Resources of the World, No. 27, Department of the Interior, 1919. Pp. 49, maps, tables.

Radium and Uranium. By R. A. F. Penrose, Jr., and R. B. Moore. Political and Commercial Control of the Mineral Resources of the World, No. 13, Department of the Interior. 13 a, Pp. 15; 13 b, Pp. 8, map.

Tungsten. By Frank L. Hess. Political and Commercial Control of the Mineral Resources of the World, No. 15, Department of the Interior. Pp. 34, map.

Vanadium. By R. B. Moore. Political and Commercial Control of the Mineral Resources of the World, No. 16, Department of the Interior. Pp. 11, map.

Foreword. By J. E. Spurr. Political and Commercial Control of the Resources of the World, Department of the Interior. Pp. 13.

Platinum. By J. M. Hill. Political and Commercial Resources of the World, No. 12, Department of the Interior. Pp. 14, map, diagram.

Potash. By A. W. Stockett. Political and Commercial Control of the Mineral Resources of the World, No. 11, Department of the Interior. Pp. 13, map.

Nickel. By C. S. Corbett. Political and Commercial Control of the Mineral Resources of the World, No. 10, Department of the Interior. Pp. 23, maps, diagrams.

Phosphate Rock. By R. W. Stone. Political and Commercial Control of the Mineral Resources of the World, No. 9, Department of the Interior. Pp. 14, map.

Monazite. By R. B. Moore. **Zirconium.** By H. C. Morris. Political and Commercial Control of the Mineral Resources of the World, No. 6 and 7, Department of the Interior. Pp. 10 and 18, map.

Molybdenum. By R. B. Moore. Political and Commercial Control of the Mineral Resources of the World, No. 5, Department of the Interior. Pp. 15, map.

Mercury. By F. L. Ransome. Political and Commercial Control of the Mineral Resources of the World, No. 4, Department of the Interior. Pp. 30, map.

Magnesite. By R. W. Stone. Political and Commercial Control of the Mineral Resources of the World, No. 3, Department of the Interior. Pp. 23, map.

Graphite. By H. G. Ferguson. Political and Commercial Control of the Mineral Resources of the World, No. 2, Department of the Interior. Pp. 11, map, diagrams.

Emery and Corundum. By Frank J. Katz. Political and Commercial Control of the Mineral Resources of the World, No. 1, Department of the Interior. Pp. 28, map.

Tin in 1918. By Adolph Knopf. I:3, U. S. Geological Survey, 1919. Pp. 9. From Mineral Resources of the United States, 1918—Part I.

Recovery of Zinc from Low-Grade and Complex Ores. By Dorsey A. Lyon and Oliver C. Ralston. Bull. 168, U. S. Bureau of Mines, 1919. Pp. 145, index.

The Oil Shales of Northwestern Colorado. Bull. 8, State of Colorado Bureau of Mines, 1919. Pp. 59, ill. Issued by the Commissioner of Mines, State Capitol, Denver, Colorado.

Natural Gas and Natural-Gas Gasoline in 1917. By John D. Northrop. II:33, U. S. Geological Survey, 1919. Pp. 86. From Mineral Resources of the United States, 1917—Part II.

Preliminary Report on the Mineral Resources of the United States in 1918. Introduction by Edson S. Bastin. Statistics assembled by Martha B. Clark from data furnished by specialists of the Division of Mineral Resources, U. S. Geological Survey, 1919. Pp. 106.

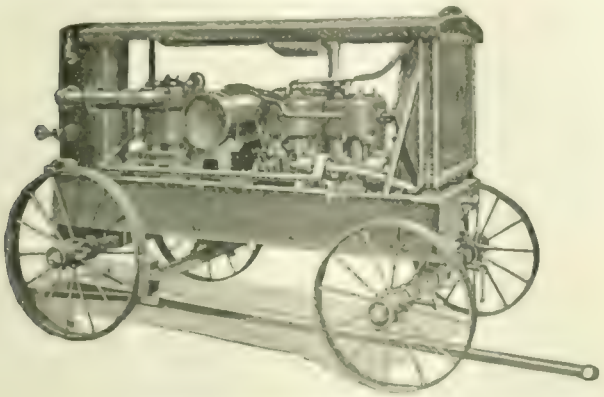
Clays and Shales of Minnesota. By Frank F. Grout, with contributions by E. K. Soper. Bull. 678, U. S. Geological Survey, 1919. Pp. 259, ill, diagram, map, index. For sale by Superintendent of Documents, Government Printing Office, Washington, D. C. Price, 25 cents

INDUSTRIAL PROGRESS

INFORMATION FURNISHED BY MANUFACTURERS

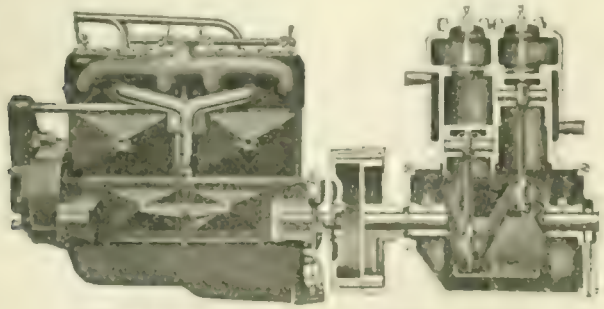
A NEW PORTABLE AIR-COMPRESSOR

Portable compressors of many varieties have been developed in the few years just past, each successive design bettering the one which preceded it. Now there appears a new type. The Ingersoll-Rand Co. has introduced a light-weight gasoline-engine driven unit, built in two sizes, to be known as the Imperial Type 14 portable compressor. These are all-steel outfits, from their sheet-steel canopy to



118-cu. ft. Imperial Portable Compressor

the broad tired steel wheels. The power plant of each consists of a duplex, vertical-compressor, driven at high speed, by a four-cylinder, four-cycle, tractor-type gasoline-motor. It is pointed out that the outfit, being designed especially for portability, has had unnecessary weight eliminated, and affords maximum air-power output per unit weight. The larger machine, of 210 cu. ft. capacity, weighs only 6000

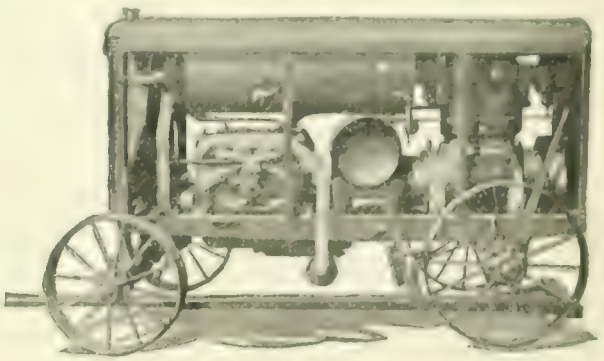


Sectional Power Plant 118-cu. ft. Portable Compressor

lb., and the 118 cu. ft. unit 4000 lb. A point is also made of the fact that the gasoline-motor drive provides power in an economical form and by a mechanism that can be confidently entrusted to the average operator, for men familiar with gasoline engines are everywhere available and make thoroughly competent engineers.

The compressors have cylinders cast 'en-bloc', with cylinder heads, valve chambers, and water jackets integral. Both intake and discharge valves are of the plate type and are situated directly over the cylinder bore. Crank shafts and connecting rods are drop forgings. Air pistons are fitted with three-piece piston rings and, in addition, with an oil-wiper ring. This latter returns all surplus oil from the cylinder walls to the crank case, and is claimed to obviate the difficulty caused by having the air carry an excess of oil into the receiver. All bearings are die castings of anti-friction metal. Hand holes in the crank-case permit convenient access for adjusting main bearings and those of the crank-pins. Al parts are lubricated by splash from an oil reservoir in the crank case. The compressors are provided with inlet unloading devices which automatically close the compressor intake when the receiver pressure rises above a predetermined limit, and permit the machine to again take up its load when the pressure has fallen a definite amount.

The gasoline driving-motors are of long-stroke type, and operate at medium speed. They are equipped with high-tension, magnetic ignition with automatic governors to main-



210-cu. ft. Imperial Portable Compressor

tain constant speed under all working conditions and to prevent overspeeding when idling. A splash oiling system lubricates all moving parts. Starting crank is located at the front of the machine beneath the radiator. Both compressor and driving-motor are water cooled by a circulating system, with centrifugal pump, large radiator, and powerful blast fan. The manufacturer directs attention to the fact that the radiators are made up of removable sections, a construction that allows the removal and repair of a damaged section without taking down the entire radiator or interrupting the use of the compressor.

Each of these units is equipped complete with receiver, safety valve, drain valves, pressure gauge, and service valves to which the air hose lines may be attached. When the fuel tank has been filled, lubricating oil provided, and the cooling system supplied with water, the units are ready for work. The mounting is worthy of note, particularly the swiveled front axle, which moves freely in both horizontal and vertical planes. This, with the rigidly attached rear axle, gives three point suspension, and permits the outfit to pass over inequalities of the ground without any racking effect or misalignment of the power plant.

The two sizes differ in respect to the situation of the air receiver, and in minor details of design. These differences, in general, can be seen from an inspection of the accompanying illustrations.

COMMERCIAL PARAGRAPHS

'The Clutch that Clutches' is the title of a 16-page booklet on the subject of Medart friction clutches, just issued by the **Medart Patent Pulley Co.**, St. Louis.

Walter Hasendahl, formerly in charge of the Allis-Chalmers Mfg. Co.'s district office in Los Angeles, has entered the firm of **Rosenburg & Co.** as their consulting engineer.

C-H space heaters are illustrated and described in a new four-page two-color 8½ in. by 11 in. pamphlet No. 479, entitled 'Miscellaneous Applications of Electrical Heat'. The pamphlet emphasizes numerous applications of electrical heat by means of flat standardized heaters, 2 ft. long, ⅜ in. thick, and 1½ in. wide. Copies may be obtained by addressing the **Cutler-Hammer Mfg. Co.**, Milwaukee.

A new bulletin on centrifugal pumps and centrifugal pumping units has been issued by the **Allis-Chalmers** company. As the manufacturers state, the centrifugal pump has been so perfected in design and improved in efficiency that it is now worthy of serious consideration for practically any class of pumping service. The bulletin contains 50 pages 8 by 10 in. Single and multiple-stage as well as typical installations are adequately illustrated and described. Many useful tables and curves are included, together with a set of instructions for installing and operating horizontal centrifugal pumps.

The Chesapeake Iron Works, of Baltimore, Maryland, manufacturers of Chesapeake electric traveling cranes, have announced the opening of their New York office in the Woolworth Bdg. The office will be in charge of H. L. Mode. Although the Chesapeake cranes are standardized, they are made in all types and sizes in any capacity, to meet every service condition. Chesapeake cranes were selected by the U. S. Government and over forty-five were used by the Base Ordnance Department in France during the War.

'Heat Insulations' is the title of a bulletin which contains an elaborate discussion of the economies possible with the proper insulation of steam generators and conductors in power-plant practice. It contains a theoretical discussion of the insulation of heated surfaces and its results in the saving of fuel, and shows how the fuel user can figure losses and how to overcome them and secure the best material for every condition that presents itself. There is also calculated the actual saving in dollars and cents on a year's basis that is possible by the proper insulation of heat surfaces. This catalogue presents in a concise and clear manner the subject of heat insulations in a form that makes the data easily available for the man on the job. It also contains detailed descriptions of the different classes of insulators used for various kinds of work and a discussion as to how to select a type of insulator best adapted to the work in hand. A copy will be sent gratis upon application to the **Franklin Mfg. Co.**, Franklin, Pennsylvania.

The firm of **Collins & Webb, Inc.**, of San Francisco and Los Angeles, are now the agents for the Fate-Root-Heath Co., manufacturers of Plymouth gasoline locomotives. Collins & Webb have the exclusive sale of Plymouth locomotives in California, western Arizona, and Nevada, and also the Pacific export business. Plymouth locomotives are being used by the following California companies: The Southern California Edison Co., which uses two; the San Joaquin Light & Power Co., which uses two in its construction work; the Western Salt Works of San Diego has just installed a new one; the State of Arizona has just purchased one; the Inyo Development Co. at Keeler, California, has one; the Lincoln Clay Products Co. at Lincoln, California, operates one; the 88 Mining Co., New Mexico, is running a Plymouth locomotive; and also the Pacific Coast Borax Co. in Death Valley. The West End Con. Mining Co. operates two at its mine near Searles Lake. Collins & Webb will be glad to supply illustrated bulletins detailing performance and records of Plymouth locomotives.

The McMyler-Interstate Co., of Cleveland, Ohio, has opened offices in San Francisco, in charge of L. A. Somers. The McMyler-Interstate Co. is a merger of the McMyler Manufacturing Co. and the Interstate Engineering Co. These two companies have an uninterrupted combined history of about 35 years in the manufacture of coal and ore-handling machinery, locomotive cranes, shipbuilding cranes, car-dumpers, pile-drivers, railroad equipment, clam-shell, scraper, and orange-peel buckets. The McMyler-Interstate Co. has contributed some notable aids to the solution of mechanical engineering problems, chief of which, perhaps, may be mentioned a 350-gross-ton capacity fitting-out crane. This crane, which has a capacity of 392 net tons, is probably the largest crane of any that has ever been built. It is electrically operated, and therefore possesses interest for electrical as well as mechanical engineers. It is now being erected in the Philadelphia Navy Yard. A special bulletin describing it in detail will shortly be issued. Mr. Somers will be glad to supply copies as soon as it has been issued. Requests should be mailed to the McMyler-Interstate Co., 407-09 Merchants Exchange Bdg., San Francisco.

The Milliken Brothers Mfg. Co., Inc., Woolworth Bdg., New York, has published a new catalogue (No. 10) descriptive of Milliken buildings. Structures of this type are built under the standardized-truss unit system, designed by the company. It makes use of a small, interchangeable, standardized structural steel unit; the buildings are all-steel, permanent and fireproof, and are furnished complete. They are suitable for all classes of industrial and manufacturing structures. The system makes possible low transportation and erection costs, allowing the choice of many buildings, all constructed under the same unit type. The catalogue is 8½ by 11 inches, and profusely illustrated with buildings of this character erected for the United States government and other important interests. Space is also given to the transmission towers, radio towers, and special poles built by the company. A companion book of like size, known as Catalogue No. 11, has been issued as an erection handbook; this forms a complete guide to the construction of any Milliken building from foundation to roof. Copies of these catalogues may be obtained free from the company by those interested.

Catalogue A, 1919, of **C. F. Braun & Co.**, manufacturing mechanical engineers, San Francisco, is an 80-page 8½ by 11-in. book of exceptionally handsome appearance. Printed throughout on a heavy coated paper, the many half-tones and line-cuts come out with a clean-cut detail that is not often found in catalogues. This catalogue, according to the Braun company, is offered as a compact reference for those interested in auxiliary machinery, and illustrates and describes briefly the Braun products, their merits and applications. Aerators, wet and dry vacuum condensers, cooling-towers, evaporators, expansion-joints, pressure and gravity filters, heaters, pipe anchors and guides, centrifugal pumps, valves, and many other forms of mechanical equipment are taken up in detail. This is, however, a condensed catalogue, intended to summarize all the Braun products. For those who are interested in special products, individual bulletins are issued, which will be forwarded on request, each describing fully the construction of each type of apparatus. A unique feature of catalogue A is a part describing and illustrating the organization and facilities of the Braun company. This has been included on the theory that the manufacturing methods and facilities employed by a builder of machinery are of vital concern to the purchaser, as they largely determine the reliability, efficiency, and life of the finished product.

AT the recent annual meeting, in London, of Minerals Separation Ltd., it was announced that Mr. John Ballot had resigned as chairman and managing director on account of his absorption in the affairs of the North American branch of the company's business. He is president of the American corporation. A vote of thanks to Mr. Ballot for his past services was carried by acclamation. At this meeting the share capital of the company was increased by 450,000 new shares, increasing the total to £500,000. Of these, 50,000 are to be issued at a premium of £1 per share *pro rata* to the present shareholders. This will be in the nature of a bonus, says 'The Mining World', because the price on the market is nearly £16 per £1 share. It was also announced at the meeting that patents have been obtained on two discoveries of great importance, opening up a glorious future for the company.

SEVERAL months ago we referred to the selection of a president of the University of California and discussed the qualifications needed for an appointment that we regarded as of the greatest importance not only to this State but to the entire Pacific Coast. After much delay and deliberation, the Board of Regents has selected Mr. David P. Barrows as president. We take pleasure in recording the fact, and congratulate both him and the University upon the appointment. The new president is a Doctor of Laws and a Lieutenant Colonel; he is a man of scholarly attainments and of virile activity; he has been an educator in the Philippines and a soldier in Siberia; he was elected recently as the chief of the Californian division of the American Legion and for two years he was dean of the faculties of the University. A good speaker, an engaging personality, a man of robust character, he brings to his work the qualities that it needs. We wish him every success in his administration and a long career of usefulness to our community.

FROM New York comes the statement that Messrs. Herbert C. Hoover, Julius H. Barnes, and Charles R. Crane have purchased the Washington 'Herald'. Mr. Crane is a son of the founder of the Crane Company of Chicago; in 1909 he was appointed Ambassador to China under the Taft administration, but resigned on the eve of sailing for his post; he was vice-chairman of the financial committee supporting President Wilson's campaign in 1912; he now ranks as a Democrat; he is a man of wide travel and is exceptionally well-informed concerning European politics. Mr. Barnes is head of the Wheat Corporation organized under the Fuel Administration. The 'Herald' not long ago was owned by the brewers trust and lately by Mr. Arthur Brisbane, henchman for Hearst. The news of this sale is interesting, because, of course, it is a step taken in preparation for the Presidential election and suggests work in behalf of a third party. Mr. Hoover's friends know that he considers the present party cleavage out of date and thinks the time ripe for a new party, a Liberal party. Speaking of these matters, we hope the day may come when the candidates for the Presidency and for other positions of great responsibility, requiring executive ability, will be chosen from among those not pre-eminent for the gift of oratory. The modern world is swamped with talk and would gain greatly by choosing as its leaders those who do more and talk less.

IN one of our local dailies we note an editorial paragraph which, among other things, states that "the cost of prohibition to the people of the United States will be about $500,000,000 annually, due to loss of revenue and expenditures for enforcing the law." We further learn that all but a small part of this is loss of revenue. The peculiar grasp of economics evinced by the writer of the paragraph is as remarkable in its way as the series of blunders committed by the liquor interests in their badly organized attempts to protect themselves against the inroads of the prohibitionists. We congratulate the scribe on advancing an entirely new theory regarding the abolition of the liquor traffic; among the various arguments that have been hurled against prohibition, we do not recall any previous ones that claimed it would be an expense to the country. The idea that the loss of taxes that were paid to the Government on a luxury will be an expense to the people is novel; whatever prohibition may or may not do, we imagine that, when the ledger is balanced, as far as expense is concerned, it will have no difficulty in justifying itself. We regret the general aridity—at times it is painful personally—but let us not 'kid' ourselves with such buncombe.

EXPORTS of copper during the first nine months of the current year amounted to 394 million pounds, as against 612 and 847 millions respectively during the equivalent period of 1918 and 1917. In value these exports were even wider apart; in 1917 they were worth 256 million dollars, and in 1918, 160 million dollars, as compared with only $90,481,732 in the nine months of

the current year. Meanwhile the cost of producing the metal is increasing steadily, owing principally to the higher wages paid to those engaged in the production. The Utah Copper gives 14.88 cents as its average cost during the third quarter, as against 11.59 and 13.72 cents in the two preceding quarters. The Nevada Consolidated gives 21.68 as its cost in the third quarter, as against 18.07 and 16.85 in the second and first quarters respectively. These figures do not take into account any credits for the value of gold and silver recovered with the copper nor for any miscellaneous income. Comparisons are made with the costs in 1915, when they were 6.76 and 8.01 cents respectively for the Utah Copper and Nevada Consolidated, but the basis of comparison, we believe, is not quite the same.

ENGINEERING COUNCIL, through its committee of 15 representative engineers, expects to have ready for presentation at its December meeting the final draft of a proposed law requiring the licensing or registering of engineers. This will then be published in the various journals and transactions of the technical societies, so that those interested will have an opportunity to become familiar with its purport. A demand undoubtedly exists for some form of regulation of the practice of engineering, similar to that obtaining in other professions, whereby the public may be protected from the activities of charlatans, who, by signing reports and otherwise undertaking work for which they are not qualified, frequently bring disaster upon those who are guided by their incompetent advice. Whether this protection can be furnished in the manner contemplated by Engineering Council will not appear until the text of the proposed bill is known. We are told that eleven States have already enacted laws in an attempt to mitigate these evils, which indicates that the need for some regulation is becoming recognized throughout this country. The present effort of Engineering Council to knit together the diverse statutes into one Federal law seems, in its broad conception, to be carefully planned; if developed wisely in its details, so that it will not place emphasis upon a university education to the detriment of the highly competent empirical man, and if it receives the necessary cooperation of engineers, it should improve the standing of the profession and its usefulness to the community.

AFTER the Armistice, the surrender of the German fleet, and the sinking of the warships in Scapa Flow, comes the public washing of dirty linen. The heroic aspects of the German struggle for world dominance have been pitiably besmirched by these later performances. We are becoming weary of the 'confessions' of the German leaders, as they slowly find their way into our papers, but we read them nevertheless, for the sake of an occasional note of high interest. Ludendorff, Bethmann-Holweg, and Tirpitz have successively laid bare their awakening from dreams of easy conquest and glorious empire. On top of these memoirs comes the publication of secret dispatches proving, as was long ago inferred, that the Austrian note to Servia and the invasion of that country were done with the connivance and at the incitement of the gang at Potsdam. Ludendorff's account of the military phase of the struggle is so inaccurate, incomplete, and insincere as to have but little historic value, while his condemnation of the civilian morale and his criticisms of the policies of his own government indicate that his nerves could not stand the test and that he was just as bewildered as the rest of them when the great collapse came. We like Von Tirpitz best; he seems franker and manlier in his attitude to the events that culminated in the defeat of his hopes and plans. Too late he deplores the insanity that drove the white races into exterminating each other, although England and America appear to be excluded from his regret. He exposes the vanity of the Kaiser and the petty irritations that determined many of his actions. Above all, these German confessions exhibit an entire absence of sorrow for the sufferings brought on humanity by the War; instead, there are repeated expressions of chagrin that the great piratic scheme failed and a regretful rumination over the factors that made its success impracticable, with the suggestion that the next time there must be no such blunders. These German leaders are entirely unrepentant of their crime, the details of which they themselves have exposed. They justify the judgments formed in the early month of the War, on the basis of the information then available, and they show how, under an autocratic regime, a few men can play fast and loose with the fortunes of humanity.

Mr. Sulman and Flotation

From London we have received the November bulletin of the Institution of Mining and Metallurgy, in which we find a paper by Mr. H. Livingstone Sulman entitled 'A Contribution to the Study of Flotation'. It is a considerable contribution in bulk, for it occupies 95 pages. Mr. Sulman is known to our readers as one of the patentees identified with the Minerals Separation company, with which American mining engineers have been in unpleasant collision for the last five years. He is one of the most successful investigators of flotation phenomena, as his many patents testify, and he is an accomplished technician in this new branch of wet metallurgy; any paper by him will command the attention of the profession and will be read with something akin to eagerness. We have read this paper already and find much in it that is interesting, but it goes over ground familiar to our readers and appears to be written as if the author were unaware of the voluminous literature on the subject that has accumulated previously. We shall reproduce most, if not all, of Mr. Sulman's paper in our columns, because we believe that it is one that American mill-men will want to read for themselves, for the sake of the occasional items of information or suggestion that it may contain; but even before doing so we think it proper to record a strong protest against Mr. Sulman's unscholarly failure to make the customary references to previous writers on his subject. In the concluding paragraph of the paper he excuses himself for his lapse of good manners by presenting

a bouquet to his business associate, Mr. John Ballot, until recently the chairman of Minerals Separation Ltd. Mr. Sulman describes his partner as "one of the original inventors" of the process, when it is well known, on the evidence of Mr. Ballot himself, that he merely instructed a member of his staff, Mr. A. H. Higgins, to make a series of experiments, ringing the changes on various proportions of oil, rates of agitation, and so forth, the consequence being to confirm the results obtained a year before by Messrs. F. A. Beauchamp and Wilton Shellshear in the Central mill at Broken Hill—results of which Mr. Ballot must necessarily have been aware, because his own respesentative, Mr. G. A. Chapman, was on the spot and participating in the Australian experiments. Mr. Sulman says that "it is impossible to recount, far less to appreciate, the part which each [of the "numerous workers"] has played in overcoming the many difficulties which have surrounded the practical application of so radical a departure from previous concentration methods", and then he points to Mr. Ballot as the one chiefly responsible, with "my [Mr. Sulman's] co-workers" in overcoming the aforesaid "many difficulties" in the way of a successful application of the process; as if the chief difficulty had not been the persistent efforts made by Messrs. Ballot, Sulman, and their associates to prevent the diffusion of knowledge concerning the process and the experimentation needed to ascertain the obscure physical principles on which it is based. If all of us had been docile, if all of us had been intimidated by the hectoring tactics of Messrs. Ballot, Sulman, and their associates, including their representative in San Francisco, there would have been precious little published on the technique of the flotation process during the 14 years that have elapsed since it was "invented" by Messrs. Ballot, Sulman, and Picard in London. Mr. Sulman proceeds to pay a tribute to the various valuable business qualities of Mr. Ballot by means of which, says Mr. Sulman, his partner "has succeeded in the firm establishment of a process of world-wide benefit to the mineral industry". How charitable and beneficent he and his friends have been is disclosed in the proceedings before the Federal Trade Commission as described by Mr. George L. Nye on other pages of this issue. The fact is that these gentlemen of the Minerals Separation company did all they could to delay the development of the process by others in order to obtain a monopolistic control of the business arising therefrom. As one of them told the present writer, they wished to check any further experimentation or writing on the subject until such time as they had a 'cinch' on the process by means of a Supreme Court decision. Mr. Ballot is not an inventor; he is the head of the patent-exploiting agency that has delayed the successful application of a process that might be "of world-wide benefit to the mineral industry". Although "invented" in 1905, it was not applied, for example, to the copper mines of the United States until 1915, because the metallurgists of the patent-owning corporation, namely, Minerals Separation Ltd., stated publicly that the process was unsuited to most copper sulphide ores, especially those containing chalcocite. Mr. Ballot, Mr. Sulman, and their associates took pains—we repeat—to prevent the publication of technical information concerning the process, and Mr. Sulman now comes forward belatedly with a paper on the physics of flotation, traversing ground previously covered, in part at least, by others, without making any acknowledgment to them; he ignores all the preceding contributions to the technology of the subject, and has the effrontery instead to pay his compliments to the man chiefly responsible for delaying, harassing, and penalizing the development of flotation as a metallurgical method.

Taxation of Mines

Following upon the discussion of Mr. L. C. Graton's paper on the Federal taxation of mines, as recorded in our issue of October 11, it was arranged for a number of mining engineers to go into conference with the officials of the Treasury Department with a view to outlining the principles on which a fair and practicable system of taxation could be elaborated. This conference took place at Washington on October 7 and resulted in an agreement upon several points. In the first place, the committee of 33 mining engineers advised that mineral properties should be divided into two classes, one to include those in which the tonnage in reserve had been determined with reasonable accuracy and one to cover those in which no close estimate could be made. In the first class were included the desseminated copper deposits of the 'porphyry' type, the disseminated lead deposits, and those of iron ore, coal, and petroleum. A sub-committee on Class I advised a method that should begin by (1) determining the recoverable tonnage reasonably assured as of March 1, 1913, and available within a period not longer than 45 years. Then it would be necessary to ascertain (2) the average profit per ton to be expected during the life of the property, by subtracting the unit cost at point of delivery from the unit selling price. Next (3) the total recoverable profit for the life of the property should be determined by multiplying the figures obtained under (1) and (2). The life of the property should be fixed by dividing the total tonnage by the annual output, taking into consideration the probable increase or decrease in production. Finally, the present cash value of the full returnable profit should be determined on the basis of a 6% return on the capital. These recommendations were to be used as a basis for modifying the various Articles in Regulation 45. As to Class II, it was agreed that sole reliance cannot be placed on the ore developed at the date of valuation, but, in order to establish a reasonable estimate of the required factors, it is advisable to consider the habit and type of the orebodies in the mine, the characteristics of the district, the rate of development by exploration, the strength of mineralization, and the stage of its operating life that the mine has attained. It was the sense of the sub-committee that "in the estimate of value, reasonable extension outside developed orebodies shall be fixed in the valuation of the mine" and, the law permitting, further ore made available either by exploration or by improved processes of

treatment may be valued for the purposes of depletion.

We give this summary of the findings of the various committees in order to show in how large a measure the Treasury officials are accepting the assistance of the mining profession in their effort to base taxation upon logical principles. It is an excellent departure; for it will render taxation not only fairer but more intelligent, and therefore more effective. A mine is a risky venture and a wasting asset; these two facts underlie the business of mining and they should be recognized in any scheme of taxation. The dividend from a mine is not income until some allowance has been made for amortization of the capital involved. However, we will not go over the old ground again; we desire only to record the good spirit shown by the tax-collecting department, and we close by suggesting that this discussion of the fundamental principles of valuation with the tax-collector will react beneficially on the profession, and upon the technique of mine appraisal, by causing engineers to review their methods in the light of the criticism to which they may be subjected by those who know little about mines in particular but a good deal about valuation in general.

Mining and Speculation—III

In our issue of November 22 we discussed sundry ideas on mining finance as expressed recently in London. These are interesting to our readers, we believe, because, by implication, they bear upon American practice in such matters. For instance, the calculations of life made for the mines of the Rand by reputable engineers have been falsified again and again by the harsh logic of events because they were based upon the assumption of a uniformity that never existed. Mr. Gallard says that this assumption—or "theory", as he calls it—"was exploded years ago". It never was justified by the experience of mining in its world-wide sense, but sprang from the characteristic provincialism of those whose experience had been limited largely to the Rand itself, and to the complacency of those who knew better. In this matter, as in others, the profession played into the hands of the promoting houses, and they in turn found no difficulty in 'persuading' the London financial press. The manner in which estimates were accepted as bible-truth by the unsophisticated public is pathetic, and the way in which this gullibility was used by the financial groups in their successful campaign to unload over-valued mining stocks provokes sardonic laughter even at this late day. Mr. Gallard says truly that engineers' reports now are more intelligible and more trustworthy than they used to be, but even now those that are given to the public are far from being the sincere statements they purport to be. When an engineer transmits his official report to a board of directors in London, or elsewhere, he usually accompanies it with a 'heart to heart' supplement in which he explains the salient paragraphs of the report and adds sundry information that he deems it wise to withhold for the directors themselves, 'putting them wise' as to one or two features that affect critically the life and productivity of the enterprise. The report as given to the public is not untrue, but it is only too often an incomplete statement, formal rather than informing concerning the real state of affairs. The idea still obtains—it used to reign supreme—that the shareholders cannot be trusted with the unvarnished facts; besides, the 'insiders', represented by the board, have the 'right' to know about the crucial developments before they are given to the public, which includes both present shareholders and those that will become shareholders in the near future by the purchase of shares—from the directors, for example. This refers mostly to bad news from the mine, but it covers also the contingency of discoveries that promise a rise in quotations. Again and again such news has been known to a select few for months before it was made public, by which time large blocks of stock have changed hands, to the advantage of the 'insiders'. In some instances the engineer himself has been a party to the deal, for the directors are not unwilling to let him in with them, because, among other reasons, it makes him a *particeps criminis*. These practices have hurt the London mining market greatly, debauching the profession for the benefit of a lot of German Jews and other persons, some of whom won knighthoods and other honors by giving part of their loot to party funds or public charities. It may well be asked why did not the Institution of Mining and Metallurgy, which we regard as in many respects the best managed and most truly professional organization of English-speaking mining engineers, take steps to correct these evils and discipline its members? The answer is that the gradation from absolute chicanery to amiable irregularity is so gentle as to defy juridical distinctions. Moreover, most of the engineers serve also as directors and make a considerable part of their income from their fees as directors. Some of them engage in promotions. The inextricable complexity of the business and the interplay of genuine engineering with blatant promoting is so intricate as to frustrate any attempt to impose a code of conduct applicable to all cases. For instance, a consulting engineer binds himself not to buy shares before his report is delivered; the report is held up by the directors—one of them an engineer—while they buy sundry blocks of shares; whereupon the consulting engineer likewise, now deeming himself free to do so, enters into the gamble, which presumes that the issuance of the report to the public will cause a rapid rise in quotations. We are referring to an incident of which we have first-hand knowledge. It is typical. The engineer was not disciplined, although the facts were known to many. Who should throw the first stone? These conditions arise largely from the fact that a considerable number of the older engineers do not go into the field; they remain in London and send juniors to inspect the mines; they become directors of companies and drift inevitably into close relations with the promoters and financial groups, to whom mining is a game that is played with loaded dice. Whether the profession can ever free itself from these associations is a question that is not easy to answer, but it provokes regret.

Technical Operations on the Suan Concession, Korea—IV

Flotation in Both Mills. Cyanidation. Tube-Milling.

By A. R. WEIGALL and J. F. MITCHELL-ROBERTS

FLOTATION. Although in the early days of this process, patents covering the Minerals Separation method were taken out in Japan, these had been allowed to lapse, and with the operation of the process in the Suan plant, no further patent in the Japanese empire is permissible. Consequently, flotation is practised in Japan without payment of any royalty. As almost every recognized form of flotation machine has been erected on the Suan Concession, and worked on an experimental scale, it seems unlikely that any flotation patent will ever become effective in Japan.

After flotation had been used successfully at both mills on the Concession, the process became widely applied in Japanese milling plants, and a large number of engineers have visited the Concession in order to see it. Several mining companies are now planning the erection of comparatively large flotation units and within the next few years there will be seen in Japan and Korea a marked advancement in the use of this method of concentrating low-grade ores.

The history of flotation on the Concession is interesting. In 1910, owing to the low copper extraction obtained by table concentration at the Suan mill, the possibilities of flotation were considered and samples of the ore were sent to Minerals Separation, Ltd., for testing. The report on these tests was that the ore was quite unsuitable for flotation. At this time flotation of copper ores had received comparatively small consideration, the principal application being to lead and zinc ores, and the possibilities of the successful application of the process to copper ores were not appreciated. Notwithstanding the first adverse reports, continued efforts were made, but without success, until finally the company's consulting engineer took a sample of the ore to Australia and had tests made there. These tests showed that not only was the ore amenable to flotation but that a high extraction was practicable. In the summer of 1913 a small flotation plant was erected at the Suan mill and operated with satisfactory results. Following this, plans were immediately drawn for the design of a permanent flotation plant to treat 250 tons per day. This plant was put into operation in the early part of 1914 and has been operated since then with marked success. It was one of the first successful flotation plants for the treatment of low-grade copper ores. In the same year the design of the Tul Mi Chung mill was completed, flotation being adopted as the chief means for saving the valuable minerals. This plant commenced operations in 1915.

From the experience gained in the Suan flotation plant, several minor improvements were introduced in the Tul Mi Chung plant, and today this plant is one of the most successful of those treating low-grade copper ore, not only obtaining a high extraction but at the same time producing a very rich copper concentrate.

The treatment at the Suan mill has for its object the further recovery of copper minerals for the table-tailing, and in this plant flotation was an addition to a plant giving a low copper extraction, although the gold extraction, principally by amalgamation, was generally good. The ore contains finely divided copper minerals, but not so finely disseminated as in the Tul Mi Chung ore. The bismuth is saved largely on the tables, but still some bismuth is further recovered by flotation and by tabling the concentrate an additional amount can be recovered in the form of a high-grade bismuth-copper concentrate. Most of the bornite recovered by flotation is found to separate out with bismuth, whereas the chalcopyrite in the flotation concentrate is left in the residual concentrate.

The chief flotation-oil used is eucalyptus, which, in spite of its nominally high cost, has proved to be the most economical oil to use, in association with a small amount of a heavier collecting oil. The use of a small amount of caustic lime at Suan has given beneficial results, whereas at Tul Mi Chung caustic soda is used. In all ores on the Concession the presence of a large proportion of limestone in the gangue precludes the use of an acid circuit, so all flotation circuits are either neutral or alkaline.

No improvement in recovery is obtained by the use of a hot circuit.

In an endeavor to obtain a cheaper substitute for eucalyptus oil, almost every known oil, and mixtures thereof, has been tried. Certain varieties of pine-oil give the next best results. Crude camphor-oils have shown some promise, but none can compare in economical efficiency with eucalyptus.

The average cost of oil is under 6 cents per ton of ore treated.

In the Suan mill the thickened pulp from the Callow cones and Kyloe thickeners goes to the flotation machines at an average dilution of 3:1.

The flotation plant comprises two machines of the Minerals Separation type. Both machines are of the kind described and illustrated in the description of the Tul Mi Chung mill. The nominal capacity of the Suan flotation plant is 250 tons per 24 hours.

The primary machine is composed of eight agitating-

boxes each 32 in. square and 4 ft. 6 in. deep, and the secondary or recleaning machine similarly has eight agitating boxes each 18 in. square by 3 ft. deep. The machines are driven by separate motors, that on the primary machine being a 60 hp. motor and on the secondary machine a 40 hp. The latter is double the capacity necessary, as the machine only actually consumes 15.7 hp. when working under normal load. This motor, however, also drives the return-pumps.

The bevel gears on these machines are made of phosphor-bronze, as described under Tul Mi Chung milling, and have given wonderfully good service. With the exception of the difference in size, the flotation machines vary but little from the design of those in the Tul Mi Chung mill.

The stirrers in the primary machine revolve at 285 r.p.m. and are of 21 in. diameter. The line-shaft driving this machine revolves at 300 r.p.m. Froth is removed from the spitz-boxes by the usual type of paddle, the radius of which is 6 in., revolving at 24 r.p.m. The stirrers in the secondary machine are 12 in. diam. revolving at 390 r.p.m., driven from a line-shaft revolving at 410 r.p.m.

The agitating-boxes were originally lined with old belting at the bottom and no lining at the tops. Now cast-iron linings are used in place of belting.

In operation, the froth from the first six spitz-boxes of the primary machine forms the feed of the secondary machine. The last spitz-box is overflowed fast and a good deal of pulp is allowed to run over with the froth, the overflow from the last box being returned to No. 1 agitating-box of the primary machine. In the secondary machine the overflow from the first four spitz-boxes is clean concentrate and the overflow from the last three boxes is returned to the first agitating-box of the secondary machine. In both machines the first agitating-box has no spitz, that is, there are eight agitating-boxes and seven spitz-boxes.

The following tabulation shows the average gold, silver, bismuth, and copper content of the various froths and products from the different boxes of the primary and secondary flotation machines at the Suan mill. The first agitating-box on each machine has no spitz-box.

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1st box	....	....		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Tailing	....	....		
Secondary feed	19.00	20.60	...	...
1st box	....	....		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible] the practice was to disregard the small percentage of bismuth in the clean flotation froth, which was run into settling-tanks from which it was trammed to the drying-house and sold on a gold-silver-copper basis. The present practice is to pump the clean flotation froth to a Card table, where a large proportion of the bismuth is separated out. The tailing from the operation, containing the bulk of the gold, silver, and copper, is then sent back to the settling-tank and sent on to the drying-house. No difficulty has been experienced in the elevation and re-tabling of the flotation froth and breaking it down for the table.

The reagents used in the primary machine are 0.2 lb. of eucalyptus oil per ton of ore milled, fed to No. 1 agitating-box by a small pump with a $\frac{3}{8}$-in. plunger. Thin coal-tar is fed to the tube-mill by a Smith feeder, the average amount being 0.25 lb. per ton of ore milled. About $2\frac{1}{2}$ lb. lime per ton of ore milled is added to the Dorr classifier, the object being to maintain the alkalinity of the pulp at about 0.02 lb. CaO per ton of solution. A mixture of equal parts of brown camphor oil and thin coal-tar is added at No. 5 box of the primary machine, the amount added being from 0.04 to 0.06 lb. per ton of ore milled.

The time required for pulp to pass through the primary machine varies from 18 to 25 minutes. The volume of the agitating-boxes in this machine is 160 cubic feet and of the spitz-boxes 180 cu. ft. Crowding-boards are used to restrict the area of the surface of the last three spitz-boxes of the primary machine and maintain the thickness of the froth.

The reagents used in the secondary machine are 0.275 lb. of eucalyptus per ton of primary froth treated, added at the first mixing-box, and lime-water containing 3 to 4 lb. CaO per ton of primary froth, added to the same mixing-box. The alkalinity of the water in the pulp is maintained at 0.01 to 0.015 lb. CaO per ton of solution. The volume of the agitating-boxes in the secondary machine is 32 cu. ft. and of the spitz-boxes 48 cu. ft. The time required for pulp to pass through the secondary machine varies from 18 to 30 minutes.

The tailing from the secondary machine is elevated to a Callow settling-cone by a 2-in. centrifugal pump, which lifts the pulp 18 ft. The underflow from this cone returns to the first box of the primary machine. The overflow, which is trapped, is clear water. Thus the secondary machine is in closed circuit with the primary machine. The tailing from the primary machine goes to a two-compartment cascade froth-trap; the froth from this trap is added to the clean froth from the secondary machine and re-cleaned on a Card table for the separation of bismuth.

The average grade of the clean flotation froth is as follows:

Gold	.25 dwt. per ton
Silver	1.6 oz. per ton
Copper	27.65%
Bismuth	1.8%

CYANIDATION. Although cyanidation has never been considered seriously in connection with the treatment of the ore of the Suan mine, owing to the relatively low grade of the mill-tailing, still several tests were carried

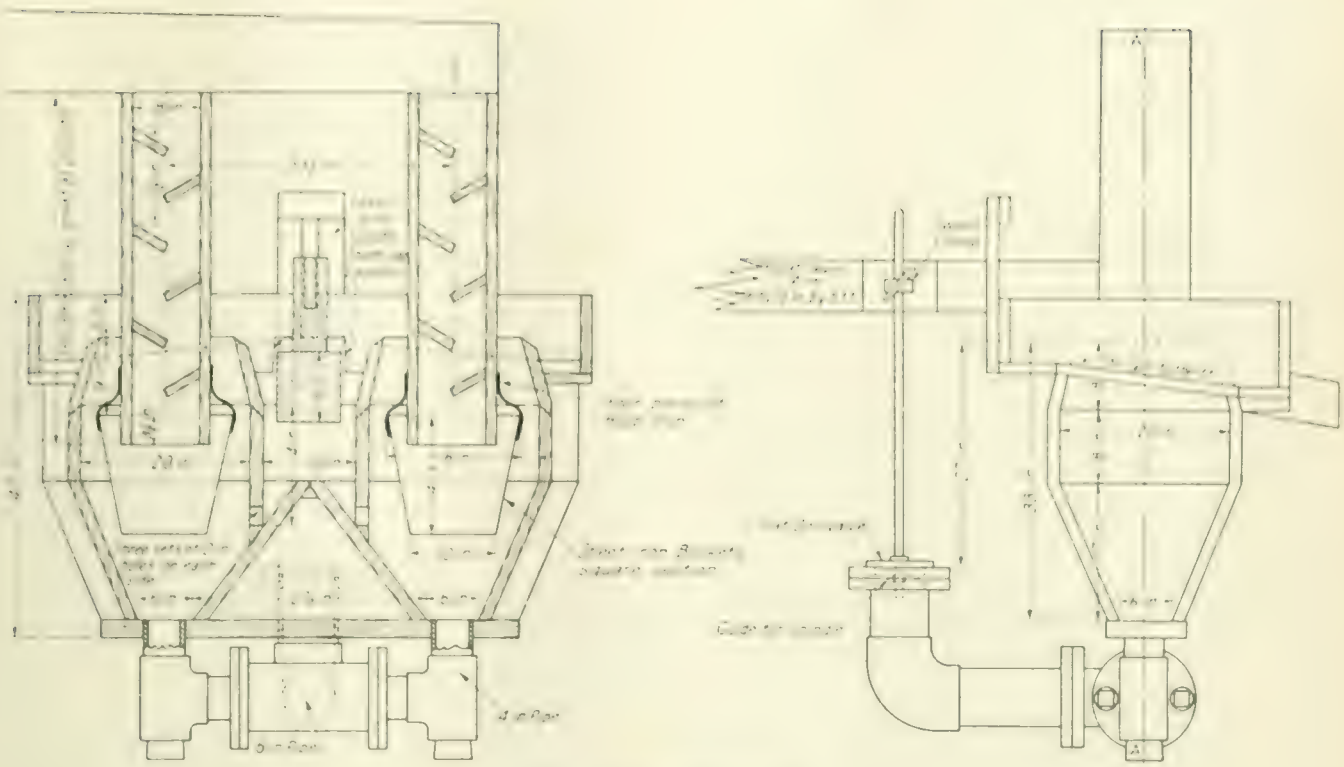


FIG. 1. SUAN FROTH-TRAP

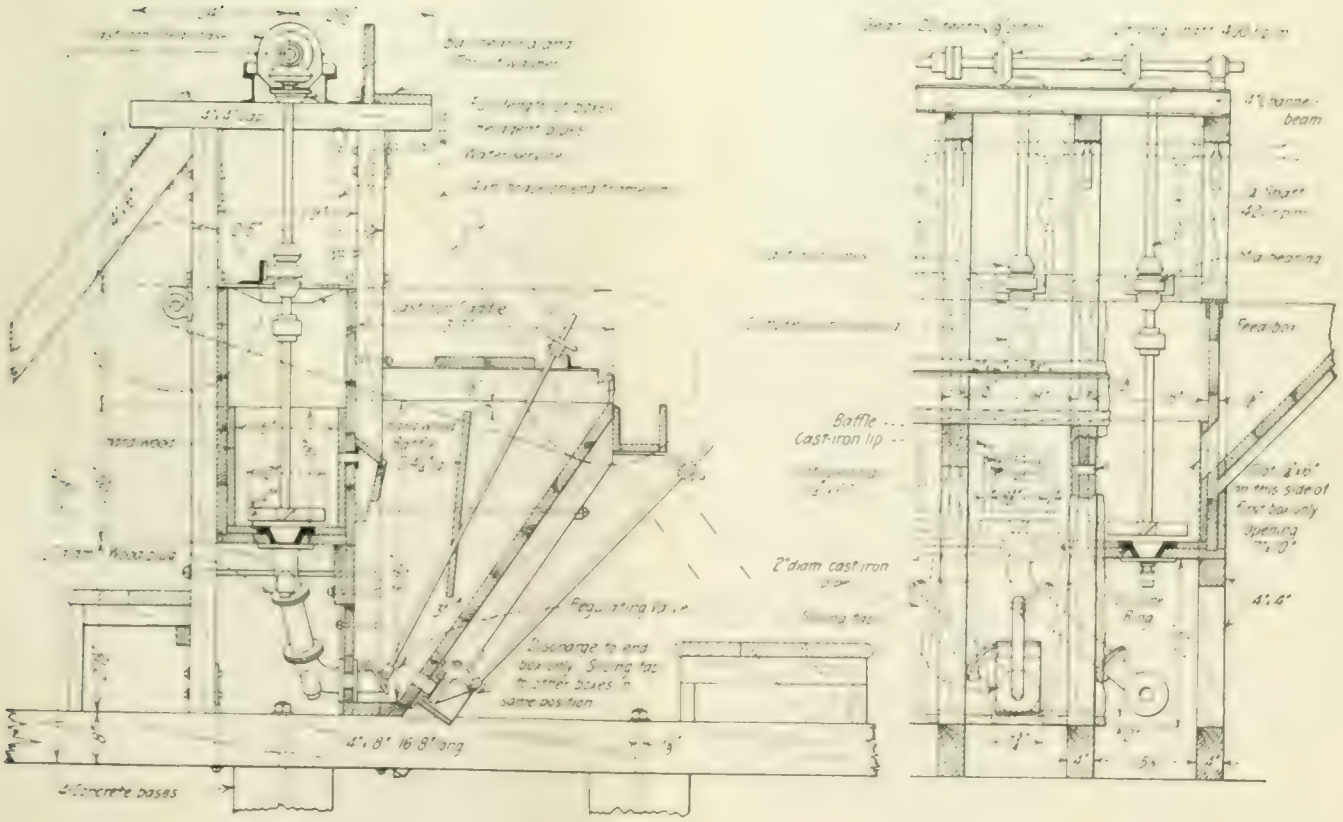


FIG. 2. FLOTATION MACHINE USED IN THE MILLS OF THE SUAN CONCESSION

out these tending to show that subsequent cyanidation of the tailing would not result in a profit, and the matter has therefore been dropped.

On the other hand, at the Tul Mi Chung mill, the initial tests that were made on the ore previous to the designing of the present mill anticipated cyanidation as an alternative to amalgamation. At this period the arsenical content of the ore was lower than it is today and amalgamation appeared to be the more promising process, notwithstanding the fact that in the tests after amalgamation and subsequent flotation there remained in the tailing over 2 dwt. of gold; it was with a view to the recovery of this residual gold that cyanidation was proposed. Subsequent tests showed that flotation followed by cyanidation of the tailing gave a higher extraction than amalgamation and flotation. However, as previously mentioned, in the original arrangement of the Tul Mi Chung mill, amalgamation plates were provided ahead of the flotation section. When it was found that the amalgamation extraction did not compare in practice with the results obtained in the original tests, further cyanidation tests were made at Denver early in 1918.

At this time the arsenical content of the ore had appreciably increased and it had been found that the arsenical minerals (arsenopyrite and lollingite) carried a considerable amount of the gold that was not being recovered by flotation; further, that it was the finest grained arsenical minerals that contained the greatest amount of gold, and these minerals were disseminated throughout the ore. Owing to the fact that the copper content of the first Tul Mi Chung samples was above that of the average of the mill-tailing, the cyanide consumption was high and the extraction of the gold normally low.

As a result of these tests it was decided to endeavor to improve the extraction of the copper by flotation, and to remove as much of the arsenical minerals as possible by the use of tables after flotation. Following the addition of the tables to the mill and the use of caustic soda as an additional reagent in the flotation section, the copper recovery improved and the copper content of the residual tailing was diminished. The operation of the tables improved the gold extraction about 4 to 5%, which was still low, so further tests were made at Denver and at San Francisco on the new tailing. The results showed that there was the possibility of increasing the total gold recovery to about 85 to 90% with a cyanide consumption of approximately 2.5 lb. per ton of tailing.

Before proceeding with the design of a large cyanide plant on the basis of the results and treatment of the later tests, it was deemed prudent to carry out further large-scale tests at the mill on current mill-tailing in order to establish the best method of procedure. At this time the average grade of the tailing was $2.50 per ton in gold value. For this purpose a complete 10-ton per day pilot testing-plant was added, in which tests could be continually carried out, and the relative merits of counter-current decantation and thickening followed by filtration could be determined.

The testing-plant was provided with the following equipment:

One 15 by 10 ft. Dorr thickener.
One 8 by 8-ft. Oliver filter.
Four 8 by 8-ft. Dorr agitators.
Four 10 by 10-ft. Dorr thickeners.
One 8 by 8-ft. Oliver filter.
One Merrill zinc-dust precipitation press, diaphragm pump, etc.

The preliminary tests that had been made had shown that a change of solution during agitation would be beneficial; accordingly, in the general arrangement of the pilot testing-plant, one of the thickeners was placed between the agitators.

The plant was operated for four months with counter-current decantation and two months with thickening and final filtering. The mechanical cyanide loss was in favor of final filtering, but the extra cost of the power necessary more than offset the saving.

Although the agitator capacity was sufficient to have given 32 hours treatment, it was soon found that an 8-hour agitation was sufficiently long, and only a very small increase was obtained by prolonging the agitation beyond this time.

There exists naturally in the ore a light slime that cannot be readily coagulated and settled, and numerous tests were carried out on the primary thickener-overflow to determine the value and amount of this non-settling slime. It was found to contain regularly 1.35 dwt. of gold per ton and to amount to practically 10% of the general mill-tailing. Further tests carried out on the overflow from the tailing-dam confirmed these tests. Apart from this slime, the remainder of the tailing is extremely free-settling, owing, no doubt, to the generally high specific gravity of the ore, which is seldom less than 3.1.

In the agitators rapid segregation of the fine and coarse sands took place, there being only approximately 9% of sand coarser than 100-mesh in the tailing during agitation. This behavior of the tailing persisted even at a dilution of 1:1 and was the cause of frequent shutdowns; it led to a series of straight-percolation leaching experiments being started.

The results of these small-scale percolation tests were so encouraging, that on the completion of the counter-current decantation and filtration tests, two of the agitators were fitted with filter-bottoms and percolation experiments were made on 10-ton lots of deslimed tailing. The continuous agitation results gave a 60 to 70% extraction with a chemical cyanide consumption of 1.6 to 1.8 lb. of cyanide on an 8-hour agitation period. The same results were obtained by straight percolation on a 4½-ft. bed of sand with a 72-hour percolation period. Throughout the tests a 3-lb. cyanide solution was used, this having been determined by preliminary experiments to yield the best results. Occasionally a 5-lb. solution was used, without obtaining better extraction results but increasing the cyanide consumption. If the solutions contained less than 0.6 lb. of cyanide, re-precipitation of

the gold took place and the arsenic began to interfere with, and foul, the solutions.

On account of the large amount of limestone present in the gangue, preliminary roasting followed by an acid leach is impracticable. The tests have shown that up to 0.09% of copper in the tailing no deleterious effects are experienced; above that percentage, however, there is a fairly rapid increase in the cyanide consumption.

In consequence of these tests, it was decided that a percolation plant is best suited to the treatment of the tailing and a 600-ton per day capacity plant has been designed; this will be erected as soon as conditions will allow of the delivery of the necessary equipment.

The plant will consist in the main of the following:

Three collecting-vats 50 by 15 ft.

Ten leaching-vats 50 by 6 ft.

One Blaisdell sand-distributor, with the necessary belt conveyors from the collecting-vats.

Three solution-vats 50 by 15 ft.

Merrill precipitation presses, pumps, etc.

Hand-shoveling will be employed for emptying both the collecting and leaching-vats. The final residue will be discharged into cars and trammed by hand to the dump. As designed, the plant will require approximately 100 hp. to operate.

With a view to ascertaining whether or not a low-grade concentrate could be produced and subsequently cyanided, numerous tests were carried out; but, owing to the high cyanide consumption, all were dismissed in favor of straight percolation of the tailing.

The sand is most difficult to handle by any system of mechanical, air, or hydraulic agitation; in a two-minute period it sets so hard as to require digging, even when the bed is only 8 to 12 inches deep. It would seem that desliming by the removal of the non-settling slime robs the tailing of its natural lubricant and is the primary cause of this difficulty.

Milling at Suan. The Suan mill was the first plant built on the Concession. It was erected during 1909 and was in operation by December of that year. It consisted of a 20-stamp mill with the necessary crushing, amalgamating, and wet concentrating machinery. This mill was increased by an additional 20 stamps, etc., and the whole 40-stamp mill was in operation in 1910. Amalgamation and table-concentration were adopted for the recovery of the gold and copper in the ore. The capacity of the mill is about 250 tons per 24 hours.

The ore of the Suan mine consists of a highly silicious magnesian limestone much altered by metamorphism. The typical contact minerals occur plentifully in the gangue, especially garnet and tremolite, the former of which increases the hardness and toughness of the ore, while the latter is detrimental on account of its tendency to choke the battery-screens and reduce the stamp-duty. In addition to gold and silver, the ore contains copper and bismuth. Visible gold is not common, but coarse gold occasionally occurs. It is alloyed with silver, the ratio roughly being 4.6 of gold to 1 of silver. The copper is present mostly as chalcopyrite, less commonly as bornite, and rarely as tetrahedrite. A high percentage of copper is usually associated with a high gold content and, though there is no fixed ratio, we find roughly that each one-tenth of a percentage of copper in the ore corresponds to about one pennyweight of gold per ton, that is, an ore with 1% of copper generally contains about 10 dwt. gold per ton. Bismuth occurs as bismuthine, and, as a general rule, the amount of bismuth in the ore appears to vary as the gold and copper in the ore.

The ore minerals are in a fine state of division necessitating fine grinding, although in this respect the fineness of the mineral in the Suan ore is not comparable to the abnormal fineness of the ore minerals in the Tul Mi Chung ore.

The composition of the ore varies so greatly in different parts of the mine that it is difficult to obtain truly representative analyses. Probably the most typical analysis was one of a composite sample made up of equal parts from some 1500 samples taken in the course of a check-sampling of the ore-reserve in the mine in 1913, when stoping was being done on every level. This composite sample had the following composition:

[illegible] residue	73.70	[illegible]	10.15
Bismuth	0.055	Sulphur	1.60
Iron	2.70	Phosphoric acid	0.02
Copper	0.92	Carbonic acid	2.92
Arsenic	trace	Undetermined and loss	1.935
Alumina	1.98	Gold	Nil wt. per ton
Lime	1.60	Silver	0.7 oz. per ton

As a rule, however, analyses showed a higher percentage of lime and magnesia than is indicated in the above analysis.

Although the ore is extremely tough and generally hard, it is not abrasive.

Power.—The Suan mill, as originally built, was steam-driven, power being supplied by a 15 by 22 by 16-in. compound tandem Ideal engine of 250 hp., 180 r.p.m., supplied with steam from Stirling water-tube boilers of 100 hp. each, working under a steam pressure of 150 pounds. The boilers were fired with cordwood burnt on specially designed grates. The concentrating tables were driven by a 15-hp. Brownhill engine, and an independent lighting circuit was provided for by a 17.5 kw. generator driven by a 40-hp. Ohman engine.

The mill was driven by steam power until the beginning of 1914, when electric power became available from the company's power plant at Pyeng Yang, some 55 miles away from the Concession. Independent motor-drives were put in and the plant thereafter operated by electricity.

The power required to operate the Suan mill averages 5571 kw. per 24 hours, equivalent to 20.767 kw-hours per ton of ore milled.

Section	Kw-hours per ton of ore milled
Crushing	1.112
Stamp-milling	7.559
Tube-mill and classifier	4.878
Concentrating tables	0.681
Flotation	6.537
Total	20.767

These figures represent the average of operations during one year, namely, 1917.

(To be Continued)

A Drill-Round Model

By WALTER S. WEEKS

Mining companies are becoming alive to the fact that there is usually a best way of doing a given piece of routine work, and they find it advisable therefore to instruct their men.

The placing of drill holes for rounds in a drift is an

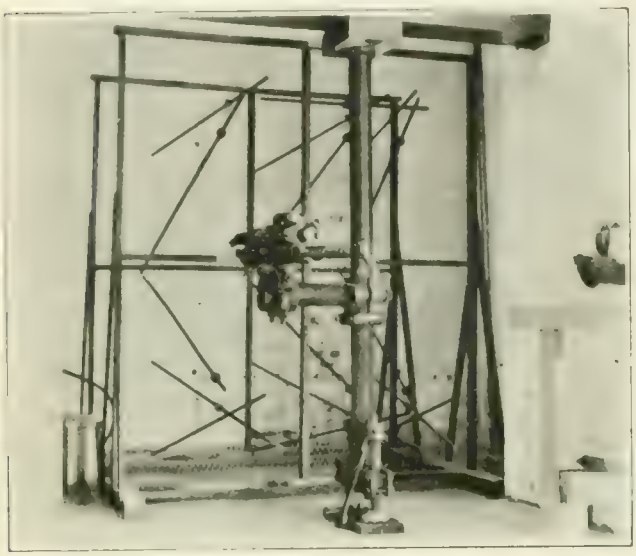


FIG. 1. FRONT VIEW OF MODEL

operation that lends itself admirably to standardization. The visualization of a drill-round in three dimensions is often difficult for a miner, so I am describing a simple

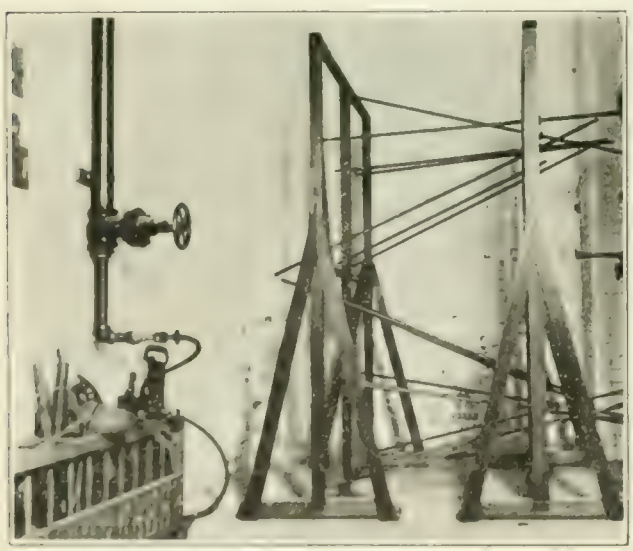


FIG. 2. SIDE VIEW OF MODEL

working model which has proved its usefulness in the Mining Department in the University of California.

The photographs are almost self-explanatory. Two frames are constructed, as shown. The one nearer the machine represents the breast of the drift and the other represents the limit of the advance. The advance can be made any distance desired by moving the rear frame. These frames are covered with chicken-wire. The drill-holes are represented by rods of wood that can be rested in any position on the wire. They are held in place by the collar shown in Fig. 3.

Suppose we wish to represent a downward hole. The

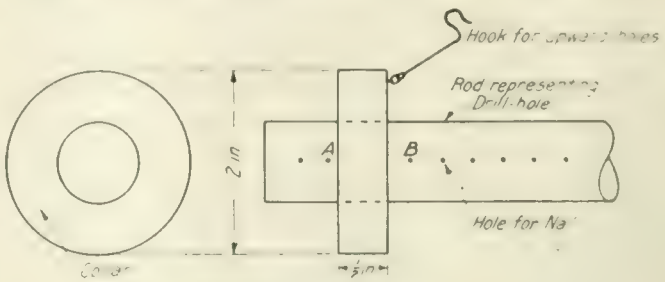


FIG. 3. THE COLLAR

collar is slipped over the rod. A small nail is put in the hole *A*. The collar rests against the wire and prevents the rod from sliding through.

Suppose we have an upward hole. The nail is placed in *B*. The hook is hooked in the wire and the rod is thus kept from sliding back.

These collars represent the actual collars of the drill-holes. Obviously any type of round can be illustrated.

GRAPHITE occurs in nature in two forms, crystalline and amorphous, and each form has its own peculiar uses. The term crystalline or flake graphite is commonly understood to mean graphite in crystals large enough to be visible to the naked eye; much of the graphite called amorphous in the trade shows a crystalline structure under the microscope. Amorphous graphite may occur wherever coal or other carbonaceous beds have been altered through the influence of neighboring bodies of igneous rock or of movements within the earth's crust. Graphite is also manufactured, chiefly by the Acheson Graphite Co., which utilizes power generated at Niagara Falls. The output has increased greatly in recent years and now forms an important element in the country's supply of graphite. The bulk graphite is made either from anthracite or from petroleum coke and is utilized mainly in lubricants but also for paints, foundry facings, boiler-scale preventives, and battery fillers. A high degree of purity is claimed for the lubricating graphite manufactured in this manner. In 1918 the Acheson Graphite Co. manufactured 9,182,272 lb. of graphite. The shipments of crystalline graphite in 1918 amounted to the record-breaking figures of 12,861,839 lb., valued at $1,454,799, according to the U. S. Geological Survey. As mine stocks were approximately the same at the beginning and end of the year, this represents about the mine production. The sales showed an increase of 22% by weight and 33% by value over those for 1917. The sales of domestic amorphous graphite during 1918 amounted to 6560 short tons, valued at $69,455, compared with 8301 tons, valued at $73,481, in 1917, and 2622 tons, valued at $20,723, in 1916. The increased use of graphite in foundry facings has absorbed the increased output in this country as well as much imported amorphous graphite, chiefly from Mexico.

Minerals Separation v. Mining Industry

By GEORGE L. NYE

*The history of the discovery of the peculiar affinity of oil for metal, as distinguished from gangue, in the mass of ore is so much a matter of every-day knowledge that it would be like "carrying coals to Newcastle" for me to undertake to repeat it to those who are probably more familiar with it than I.

The history of Minerals Separation Ltd. is quite a different matter, even more interesting and not by any means so well known. I shall refer to some of it for your enlightenment and, I trust, to your advantage.

Minerals Separation Ltd. was organized under the British Companies Act in December 1903, and its charter is sufficiently broad to permit it to do practically everything under the shining sun except practice medicine or preach the gospel, but it soon became manifest that it was intended for a particular line of endeavor, and its paths since then, although devious, have been well defined, and its trail on the heels of the mining industry, which it has stalked from the beginning of its career, is well marked and unbroken.

In August 1910, Minerals Separation Ltd. caused Minerals Separation American Syndicate to be organized to acquire a two-year option on certain patent-rights for the United States, Canada, and North America, the Caribbean Sea countries generally, including Mexico and Cuba. A month later, this concern and Minerals Separation Ltd., the parent company, entered into an agreement to organize a third company to purchase these patent-rights. This company was actually organized as Minerals Separation American Syndicate 1913, and did later acquire and exploit these patent-rights.

Immediately after the organization of Minerals Separation Ltd., as disclosed by the records, Kindersley & Pusch, understood at that time to have been agents of the German metal trust, became large and prominent stockholders.

Albert Sondheimer, of Beer, Sondheimer & Co., which in 1910 controlled the principal zinc and lead markets of the world, was one of the original directors of Minerals Separation American Syndicate, and in the third or purchasing company Nathan Sondheimer was a director and Emil Beer an alternate director. In this third company, Kindersley & Pusch were the largest and Beer, Sondheimer & Co. the second largest stockholders.

How did these German interests get this control of English companies? Probably because the first considerable development and use of flotation was in connection with the lead and zinc mines of Australia, where, at the time, the entire output was absolutely controlled by Beer, Sondheimer & Co.

The history of the struggle of Australia to throw off the yoke, and the years of resultant litigation, which only ended with drastic legislation forbidding any but British subjects to deal in lead and zinc, would make a chapter by itself, for which there is no room here.

In June 1913, Minerals Separation American Syndicate 1913 was incorporated, and in the following September it made an agreement with Beer, Sondheimer & Co. appointing the latter sole agents in the United States for all the patent-rights of Minerals Separation American Syndicate 1913. We might pause here to remark that the first suit in the United States (Minerals Separation v. Hyde) was brought in 1911 and alleged ownership in Minerals Separation, notwithstanding the option held by Minerals Separation American Syndicate and the contract of 1910 to organize a corporation to acquire title to the patents in America.

Beer, Sondheimer & Co. operated as sole agents of Minerals Separation in the United States at least until the outbreak of the European war, and probably for quite a time thereafter. During the War, the existence of the contract undoubtedly caused grave concern to Minerals Separation, and many efforts were made to avoid violating the British 'Trading with the Enemy Act', but through an unwillingness of the American representatives of Beer, Sondheimer & Co. and the hesitation of Minerals Separation to take advantage of the termination of the Beer, Sondheimer & Co. contract, by the declaration of war between England and Germany, only such changes as were absolutely necessary to screen the real situation were made. Not until November 1916 were the internal agonies of this German-controlled British concern for the three preceding years made known, by the filing, at Somerset House, of a contract dated August 4, 1916, between Minerals Separation American Syndicate 1913, first party, John Ballot as purchasing trustee, second party, and Benno Elkan and Otto Frohnknecht, described as doing business as Beer, Sondheimer & Co., American Branch, third parties and beneficiaries.

The agreement recites the ownership by Minerals Separation American Syndicate 1913 of the patent-rights already mentioned, the contract appointing Beer, Sondheimer & Co. sole agents for America on a commission basis, and then follows a recital that "by instrument of declaration and guarantee executed by the agents", that is, by Elkan and Frohnknecht, on October 5, 1914, it was declared that the original agency contract had been performed on the part of Beer, Sondheimer & Co. exclusively by Elkan and Frohnknecht and that the only benefits that

*An address delivered by the Special Counsel for the American Mining Congress, in the Federal Trade Commission enquiry, at the St. Louis convention.

had arisen to Beer, Sondheimer & Co. of Frankfort, or Beer, Sondheimer & Co., American Branch, had been commissions on royalties paid over to Minerals Separation American Syndicate 1913; that deduction of such commissions had been discontinued prior to the War and had not been resumed; that in order to eliminate all questions as to enemy character of Elkan and Frohnknecht and for the purpose of allowing Minerals Separation American Syndicate 1913 to continue trade relations with them, they undertook that they would not pay, directly or indirectly, anything of value arising from their connection with Minerals Separation American Syndicate 1913 to Beer, Sondheimer & Co., and would not deduct any commissions in any event until after the close of the War, and that trade relations between Minerals Separation American Syndicate 1913 and Elkan and Frohnknecht should be to the entire exclusion of Beer, Sondheimer & Co.

The agreement goes on to recite that subsequent to the delivery of the alleged instrument of declaration and guaranty, the original agency-contract was superseded by a contract entered into between Minerals Separation American Syndicate 1913 and Elkan and Frohnknecht on January 6, 1915, in which Elkan and Frohnknecht were appointed sole agents of Minerals Separation American Syndicate 1913 in America and the Philippine Islands, for the purpose of exploiting the patents.

It is worthy of note that the alleged agreement of January 6, 1915, did not appear of record at Somerset House in November 1916, at the time the contract of August 4, 1916, was filed; in fact, so far as our present information goes, it has never appeared on the public records. In April 1915, during the progress of the trial of Minerals Separation against Miami Copper Co., in the U. S. District Court in Delaware, for alleged infringement of plaintiff's process patents, plaintiff, on April 5th, put on the stand one Harry Falck, who testified:

"I reside in New York and am general office manager of Beer, Sondheimer & Co."

When asked, "Beer, Sondheimer & Co. stand in what relation to Minerals Separation Ltd. or Minerals Separation American Syndicate 1913 Ltd?" Mr. Falck replied, "They are agents for the Minerals Separation American Syndicate 1913 Ltd. for North America, Cuba, including the West Indies." When asked if "it is a part of your duty, as office manager for Beer, Sondheimer & Co., to be familiar with the granting of licenses and the payment of royalties under licenses in regard to Minerals Separation Ltd. patents?" Mr. Falck replied, "Yes, sir."

Mr. Falck then testified that the books of original entry of Beer, Sondheimer & Co. were prepared under his supervision and checked by him. When asked if "in the ordinary course of business the check comes in to Beer, Sondheimer & Co.?" Mr. Falck replied, "Yes, mostly."

Q. "If not, the payment is noted by Beer, Sondheimer & Co?" A. "Yes, that is it."

Bearing in mind that all these questions were asked by counsel for Minerals Separation Ltd., it is plain that the witness intended to state that as late as April 5, 1915, Beer, Sondheimer & Co. were in fact acting as agents for Minerals Separation Ltd. and Minerals Separation American Syndicate 1913 Ltd., and an exhibit which he put in evidence, prepared by him, entitled 'Statements of Accounts of Royalties of Minerals Separation Ltd.' shows payments collected by Beer, Sondheimer & Co. as late as March 8, 1915, and amounting to thousands of dollars.

In view of this testimony, it would seem to be a matter of some question whether recitals in the agreement of August 4, 1916, to the effect that the relationship with Beer, Sondheimer & Co. had terminated in 1914, were entirely correct.

The naturalization records in New York show that Otto Frohnknecht was born in Frankfort, came to the United States June 10, 1906, and had continuously resided in the United States up to the time that he made his first declaration of intention to become an American citizen, on August 4, 1914, the very day of the declaration of war between Great Britain and Germany. He was admitted to citizenship on February 6, 1917. The same records show that Benno Elkan was born in Frankfort, came to New York June 7, 1906, made his first declaration February 11, 1915, and was admitted to citizenship on May 22, 1917.

The records in the office of the Secretary of State of New York show that August 26, 1915, a company was incorporated, under the corporate title of Beer, Sondheimer & Co., Inc., with its principal place of business in New York City, with Benno Elkan, Otto Frohnknecht, Harry Falck, James A. Nelson, and William A. Cooper as its directors for the first year. Elkan was president, Frohnknecht vice-president, and Nelson secretary. The name of this corporation is nowhere mentioned in any of the agreements with Minerals Separation and its various subsidiaries, and no records concerning it appear at Somerset House. It is quite conceivable that one of the purposes of the American corporation, Beer, Sondheimer & Co., Inc., was to enable Minerals Separation Ltd. and its subsidiaries in America to give the technical appearance of truth to their statements that they were in no manner connected with Beer, Sondheimer & Co., meaning the American corporation instead of the German copartnership, relying upon the fact that connection with the German concern was indirect and by representation, rather than by a direct connection.

The British black-list, which was published in July 1916, included Beer, Sondheimer & Co., and the subsequent declarations of British officials indicate the intention of the British government to reach the American end as well as the parent institution, but the absence of any record in England of the organization of Beer, Sondheimer & Co., Inc., the American corporation, left a loophole for continued technical denials, with some semblance of truth.

The agreement between Minerals Separation American Syndicate 1913 and Ballot, as purchasing agent for Elkan and Frohnknecht already referred to, provided that Ballot should cause a Delaware corporation to be organized, with shares without par value, to acquire all of the

property of Minerals Separation American Syndicate 1913 and issue part of its stock therefor. The agreement further provided that the alleged agency agreement of January 6, 1915, should be amended so as to relieve Minerals Separation American Syndicate 1913 and also the proposed Delaware company from the payment of commissions, and that in consideration thereof, certain shares of stock should be issued to Elkan and Frohnknecht and exchanged for voting certificates for a period of five years. Of course, this manifestly was intended to carry the whole thing over until after the conclusion of the European war, and thus relieve many embarrassing situations. As matter of fact, as it later developed in parliamentry debates in England, this contract was subsequently modified to possess a duration coterminous with the War.

The proposed new corporation, which was given the name of Minerals Separation North American Corporation, was actually organized in December 1916, but under the laws of Maryland, instead of Delaware. On March 26, 1917, Minerals Separation American Syndicate 1913 was wound up by appropriate proceedings in England, where it was incorporated.

It has been constantly asserted by Minerals Separation and by the North American corporation that Beer, Sondheimer & Co. no longer, directly or indirectly, control or act as agents for Minerals Separation Ltd. or any of its subsidiaries, but as to the date when such agency terminated, there seems to be no unanimity among the various statements. If the recitals in the agreement of August 4, 1916, between Minerals Separation American Syndicate 1913 and John Ballot are to be believed, that relationship terminated in October 1914, yet according to these same recitals, Minerals Separation American Syndicate in January 1915, appointed Elkan and Frohnknecht its agents, and on April 5, 1915, Harry Falck testified that Beer, Sondheimer & Co. were still collecting royalties and presumably paying themselves commissions. Another rather striking feature is that as late as January 1917, Minerals Separation North American Corporation had on its letterhead the statement that Beer, Sondheimer & Co., 61 Broadway, were its general agents.

Possibly these matters of history, thus briefly recited, are of no particular concern, in view of what we may designate the technical legal position at the present time under the patents, but nevertheless history is usually interesting, oftentimes enlightening, and frequently of benefit in the matter of present negotiation and future relationship.

PRESENT PREDICAMENT. The American patent now known as "Fraction of 1% oil", No. 835,120, was granted to Sulman, Picard, and Ballot on November 6, 1906. Patent No. 962,678 (soluble frothing-agents) was granted to Sulman, Greenway, and Higgins on June 26, 1910. A third, No. 1,099,699, was granted on June 9, 1914, to H. H. Greenway (phenol or cresol cold without acid). All now belong to Minerals Separation North American Corporation, and they are the only patents out of the 53 varieties claimed by them which have been litigated.

It is now definitely settled by the case of Minerals Separation v. Butte & Superior, 250 U. S. 336, decided by the Supreme Court of the United States on June 2, 1919, that the use of less than 1% of oil on the ore infringes patent No. 835,120, and that the use of more than 1% of oil on the ore does not infringe that patent.

The license-agreement which has been in use for some time by Minerals Separation North American Corporation is in many respects a most remarkable document.

Paragraph 1 contains a blank for a description of the royalties to be paid, and, according to the best information obtainable, this blank has been variously filled to suit the situation in respect to the particular licensee.

Paragraph 2 requires the licensee to keep records of all concentration operations, whether by flotation under Minerals Separation process or by flotation under rival processes, or by older forms of concentration, such as hand sorting or gravity concentration by the use of jigs, vanners, tables, and cyanidation. In many instances, royalties are exacted from licensees not only on the concentrates resulting from the use of Minerals Separation processes, but also on all concentration resulting from any process, whether covered by Minerals Separation patents or not, presumably upon the theory that if the Minerals Separation patent is used at all in the general process of concentration, the whole recovery should pay tribute to those who control what they are pleased to regard as an essential element of the whole process.

Paragraph 3 requires that the licensee, during the continuation of the license shall "promptly communicate and explain to the licensors every invention or discovery made or used by them which may be an improvement, modification, or addition to any of the inventions *specified in the letters patent*. It further provides that all such inventions and discoveries become the property of Minerals Separation, leaving the licensee who has invented the same only shop-rights for the use of his invention, and that Minerals Separation thereafter may grant licenses thereon and derive a profit therefrom.

This clause, of course, was intended to and does give to Minerals Separation a complete control of all future development in the art of flotation. Not only does it include every new process, but it includes also apparatus, so that the whole field is brought within the complete domination of Minerals Separation. This paragraph also requires the licensee to bind its employees to assign and transfer to Minerals Separation any invention made by them during their employment. Thus the control of Minerals Separation is extended over future inventions in the art of flotation beyond inventions made by the licensee, and includes all inventions made by employees.

The paragraph further provides that the licensee shall not, without the written consent of the licensor, during the *continuance of the license*, use or employ any improvement, modification, or addition to any of the inventions *specified in the letters patent* "within this license", which improvement, modification, or addition is not the property of the licensor.

When we consider that Minerals Separation is in a

position to claim that any invention in any branch of the art of flotation is in some way an improvement, modification, or addition of its own inventions, it is perfectly obvious that the purpose and result of this clause is to require the licensee to obtain permission from Minerals Separation before it can use any improvement in the art which the future may bring.

Paragraph 4 provides that the licensor shall give assistance, information, and advice to licensee whenever required, upon licensee paying out-of-pocket expenses.

Paragraph 5 provides that licensee shall not, directly or indirectly, during the license period or thereafter, dispute or object to the validity of the letters patent within the license or the novelty or utility of the inventions specified therein.

Paragraph 6 clinches the contract by forbidding the licensee to use any licensed inventions otherwise than in accordance with the agreement. It further forbids the licensee assisting any hostile party in litigation against Minerals Separation and from appearing in court or giving to the court the results of his own observation, use, or experience.

Paragraph 7 forbids the licensee to sell or dispose of any machinery or apparatus, the subject-matter of any of said letters patent, unless sold to a responsible party who will, in turn, agree to take a license from Minerals Separation Ltd.

Paragraph 8 gives licensor the right of inspection and examination.

Paragraph 9 provides that the licensee shall not, without the written consent of licensor, communicate any details connected with the working of any of said inventions, modifications, additions, or improvements to any third party. This again emphasizes the restraint imposed by Minerals Separation upon any dissemination of information except under its direction or control. This restraint upon the spread of knowledge is not only adverse to the public interests, but is certainly against public policy.

Paragraph 10 of the license-agreement provides that the licensor, when required by the licensee "shall prepare and supply, as soon as may be possible, plans and specifications of the plant for the working of said invention". This paragraph must be read in connection with the previous paragraph which, in effect, forbids the licensee to use any apparatus except that specified by the licensor, and read in this connection, it simply makes more definite and positive the restraint imposed by the previous paragraph.

When we come to the question of royalties, we reach a most interesting field. T. J. Hoover, one-time manager for Minerals Separation, and who resigned his position in 1910, published a book in 1912 entitled "Concentration of Ores by Flotation". In this book, on page 163, he says:

"The average royalty charged by the process owners for the use of these flotation processes (referring to Minerals Separation Ltd.) is one shilling (25c.) per ton of ore treated. This is a very high royalty as measured by others with which miners and metallurgists are familiar. It is conceded that the inventor deserves compensation for his ingenuity, but one shilling per ton is about four times as large a royalty as the mine manager would expect."

In this connection, it perhaps is well to note that when the plan of Minerals Separation to charge royalties upon all values recovered by concentration, when flotation was used as any part of the process, was vigorously combated and contended against by applicants for licenses as unreasonable, unfair, and unjust, and when absolutely driven from its position by the logical force of the arguments against such an arrangement, Minerals Separation very gallantly came to the front and announced that it was going to change its policy in respect to royalties and was going to offer to applicants for a license an opportunity to make a selection and to determine for themselves whether they would pay a license charge upon the whole recovery or a license charge upon that portion recovered by the flotation process alone. This offer seemed to afford some means of at least partial relief, until a careful analysis was made of the different bases for royalty computation in the suggested new contract. This computation quickly demonstrated that whichever plan the licensee chose, the charge was practically the same; in other words, Minerals Separation caught them going and caught them coming.

To make a concrete illustration, let us suppose that in the whole concentration process of a particular licensee, four tons of ore are treated, from which ore old-fashioned and well-known processes extract four-fifths of the recoverable value and oil-flotation one-fifth. Under the original plan of royalty payment, the licensee would be paying 25c. per ton of ore treated, or $1. Under the new plan, the licensee would be paying only upon the amount of metallic value recovered by oil-flotation, but instead of paying one-fifth of the original charge, he would be paying five times as much and Minerals Separation would get its dollar just the same.

It is perhaps purposeless at this time to go into detail concerning the different decisions in the now famous cases of Minerals Separation v. Hyde, Minerals Separation v. Miami Company, and Minerals Separation v. Butte & Superior. All three cases were fought through the several courts, and two of them, at least, reached the Supreme Court of the United States. As already pointed out, the most recent decision of that court fixes the status of the fundamental patent, namely, 835,120, or a fraction of 1% oil, and makes perfectly plain the effect of its original decision in the Hyde case. Minerals Separation is at last confined definitely to a royalty upon the use of the oil-froth where less than 1% of oil on the ore is used.

In order to recover in the Hyde case, Minerals Separation had to take a fixed and definite stand to the effect that its patent made an entirely new discovery, one wholly unknown to the previous art, namely, that with a percentage of oil away below any previously used, coupled with violent agitation, a new phenomenon appeared in the peculiarly coherent and persistent froth which was produced and which carried the metallic particles to the

surface, where they were easily skimmed and recovered.

Their counsel, before the Supreme Court of the United States, in answer to direct questions from the bench, announced that when the inventors began to cut down the quantity of oil below one-half of 1%, then first the invention began to appear, and it was their insistence that their invention lay in the very low percentage of oil used, thereby drawing a well-defined line between the claimed invention and the previous art, that they were enabled to maintain their process patent.

In that same litigation, they contended that their invention could not be practised with more than 1% of oil on the ore, but when it came to the Butte & Superior case, Minerals Separation very artfully took the position that no matter how much oil was used, and notwithstanding the fact that the quantity might be in excess of 1% in actual practice, nevertheless the efficient oil and consequently the oil of the process was less than 1%, that anything above the "critical proportions" referred to in their patent was surplusage and wholly ineffective, if not detrimental to the process, and that consequently any use of oil in flotation was an infringement upon their process.

This contention may have been quite natural, but if successful it would have meant that notwithstanding the fact that their patent confines itself to a fraction of 1%, it would, in effect, have been a patent upon any use of oil in the flotation and recovery of the metallic values in ores. This contention was very properly exploded by the Supreme Court in the Butte & Superior case. It was there said:

"From this consideration of the terms of the patent as written, it is apparent that it makes no differentiation whatever either in the claims or in the specification among the oils having a preferential affinity for metalliferous matter, and that its disclosure, to which the petitioner must be limited, is that when a fraction of one per cent on the ore of any such oil is used in the manner prescribed, there will be produced a metal bearing froth, the result of the process. No notice is given to the public and it is nowhere 'particularly pointed out' in the claims that some oils, or combinations of oils, having a preferential affinity for metalliferous matter, are more useful than others in the process, or that some may be used successfully and some not, or that some are 'frothing oils', a designation not appearing in the patent, and that some are not. The patentees discovered the described process for producing the result or effect, the metal bearing froth, but they did not invent that result or froth—their patent is on the process. It is not and cannot be on the result—and the scope of their right is limited to the means they have devised and described as constituting the process."

This decision of the Supreme Court undoubtedly ends the determined effort of Minerals Separation to acquire a complete and absolute monopoly of all oil-flotation, but unfortunately it does not end the grip of the monopoly on an essential and very practical part of the metal-producing industry.

Federal Outlook. In the fall of 1918 complaint was made to the Federal Trade Commission that Minerals Separation was violating the provision of the act creating the Federal Trade Commission and also the provisions of the Clayton Act. After an investigation, a complaint was lodged by the Federal Trade Commission and Minerals Separation Ltd. and all its subsidiaries and agents were made parties defendant in the proceeding. In due course, pleadings were filed on behalf of all the defendants. At this stage of the matter, your American Mining Congress took a hand on behalf of the mining industry of the United States.

The American Mining Congress, after a careful consideration of the situation, concluded that the proceeding before the Federal Trade Commission must be carried on, and that a complete determination of all questions involved in the complaint against Minerals Separation must, if possible, be thrashed out in the interests of all who were using or who might use the oil flotation process, and undertook to answer the following questions from the authorities.

1. Are Minerals Separation North American Corporation and other respondents engaged in inter-state commerce, and are the transactions complained of methods in inter-state commerce?

2. Are the acts complained of methods of competition?

3. Are the practices of respondents in insisting upon terms in their license agreements which give them unified control over patents which, under separate control, might be used in competition with each other, and their control over inventions discovered by their licensees and their employees unlawful practices, in violation of law and public policy?

4. Has the Federal Trade Commission, in any event, jurisdiction in respect of the alleged exorbitant and discriminatory royalties?

I shall not undertake to discuss all the authorities bearing on these several questions of law, but I shall content myself with reference to a few of the general principles enunciated by the Supreme Court of the United States in decisions which conclusively show that the answer is 'Yes' to all four of the questions.

In the famous case of Gibbons v. Ogden, 9 Wheaton 1, Chief Justice Marshall said:

"Commerce undoubtedly is traffic, but it is something more. It is intercourse."

In Pensacola Co. v. Western Union Co., 96 U. S. 1, it was said:

"It is not only the right but the duty of Congress to see to it that intercourse among the States and the transmission of intelligence are not obstructed or in any way encumbered by State legislation."

In International Textbook Co. v. Pigg, 217 U. S. 91, it was held that intercourse by means of correspondence through the mails, with agents and scholars, was inter-state commerce.

In U. S. v. United Shoe Machinery Co., 234 Fed. 127, 145, it was said:

"It is sufficient to say that as new methods of transact-

ing business are devised, if they are found to be in effect methods of carrying on commerce in any business, and the means for commercial transactions between the owner of the article on the one hand, and the person who wants to deal in it or use it in carrying on his business on the other hand, *whether it be manufacturing, selling, trading, leasing, transportation, communication, or information, and it is sent or transported from one State to another, it is inter-state commerce,* and therefore, subject to be regulated by Congress under the commerce clause of the Constitution."

In Marienelli v. United Booking Offices, 227 Fed. 165, it was held that booking performers for a theatrical circuit, which requires them to pass from State to State, taking with them paraphernalia and stage properties, constitutes inter-state commerce.

In the light of these authorities, when we take into consideration the fact that every license agreement put out by Minerals Separation requires the constant transmission from the point where the mining books of account are kept to the head office of the company in New York of all information in respect to concentrates produced, methods employed in operation, information as to assays, recoveries, discoveries, and the like, that it is sending its agents, engineers, auditors, and other representatives throughout the various States of the Union, there can be no question whatever but that it is engaged in inter-state commerce.

I have already pointed out the several provisions of the licenses granted by Minerals Separation which require all further discoveries and inventions by licensees or their employees be made over to it for its exclusive operation, use, and benefit. There can be no question but that Minerals Separation is engaged in methods of competition with respect to all inventors, manufacturers, vendors, and users of processes or apparatus which in no manner infringe upon or conflict with the processes practised and the apparatus used by Minerals Separation; but if it be answered that there are none such, that Minerals Separation is in the field alone, that it possesses, by virtue of the patent laws, a legal monopoly, the answer is that by its methods of licensing, by which it seeks to and does obtain an absolute and complete control over every discovery and invention of each and every licensee and all employees of its licensees, it is engaged in competition within the meaning of Section 5 of the Federal Trade Commission Act, for if its acts are designed to and do prevent competition against it on the part of other individuals or concerns which might be competitors and such acts are done for the purpose of stifling and suppressing competition, they must be regarded as acts actually directed against competitors, actual or potential, and in violation of Section 5 of the Federal Trade Commission Act. It surely does not need any argument to demonstrate that the most effective means of competition known to modern business is to stifle all such competition. This has been characterized over and over again as competition, and decisions of the Federal Trade Commission in the case against the Cudahy Packing Co. and numerous other cases recognize and affirm the doctrine.

When we come to consider the question of public policy in respect to the methods employed by Minerals Separation, we should first consider again the fact that Article 3 of the license requires the licensees to communicate and turn over to Minerals Separation every invention or discovery made by them or their employees during the continuance of the license agreement, and that elsewhere in the agreement the duration of the contract is the term of the patents within the license, or any additional patents that may be added thereto by the licensors, and we then discover that the practical effect of the contract is to make its terms perpetual.

It may be seriously doubted whether, if this practice is permitted and the license is enforced in accordance with its strict terms, the licensees do not contract in such a way that notwithstanding the expiration of the fundamental patents by lapse of time, the contract will continue in force so long as Minerals Separation has any live patent on process or apparatus, and the licensees be required to pay tribute to the licensor for a period far beyond the time intended by the act of Congress in creating a patent monopoly.

Right here, it is well to call attention to the fact that in Pennock v. Dialogue, 2 Peters 1, decided in 1829, Justice Story said:

"While one great object (of our patent laws) was by holding out a reasonable reward to inventors and giving them an exclusive right to their inventions for a limited period to stimulate the efforts of genius, the main object was to promote the progress of science and the useful arts."

Again in Kendall v. Windsor, 21 How. 322, it was said:

"It is undeniably true that the limited and temporary monopoly granted to inventors was never designed for their exclusive profit or advances; the benefit to the public or community at large was another and doubtless the primary object in granting and securing the monopoly."

Referring to these cases and quoting from them with approval, the Supreme Court, in Motion Picture Patents Co. v. Universal Film Co., 243 U. S. 502, said:

"The primary purpose of our patent laws is not the creation of private fortunes for the owners of patents, but is to promote the progress of science and the useful arts."

In Straus v. American Publishers Assn., 231 U. S. 222, contracts otherwise clearly within the terms of the Sherman Act were claimed to be justified because of rights secured under the copyright laws of the United States, but it was said by the Court:

"It cannot be successfully contended that the monopoly of a copyright is in this respect any more extensive than that secured under the patent law. No more than the patent statute was the copyright act intended to authorize agreements in unlawful restraint of trade and tending to monopoly, in violation of the specific terms of the Sherman law, which is broadly designed to reach all combinations in unlawful restraint of trade, and tending,

because of the agreements or combinations entered into, to build up and perpetuate monopolies. . . . The patent statute and the Sherman act are each valid laws of the United States. While a patentee should be protected in the exercise of rights secured to the inventor under the patent system enacted into the laws of the United States, there is nothing in the act which gives the patentee a license to violate other statutes of the United States, and certainly not the one now under consideration."

From these references to and quotations from a few only of the many decisions to the same effect, it is seen that it is clearly against public policy to permit the owners of a patent monopoly to broaden and extend that monopoly beyond the strict limitations which the law gives as a stimulus to the inventive genius.

When we come to a consideration of the question as to the jurisdiction of the Federal Trade Commission in respect of the acts of Minerals Separation and the exorbitant and discriminatory royalties demanded by it, we find equally emphatic approval in the decisions of the Supreme Court under the Sherman Act. That act has been interpreted by the Supreme Court to authorize decrees not only enjoining proved violations of it, but also decrees "re-creating out of the elements now composing it a new condition which shall be honestly in harmony with and not repugnant to the law." U. S. v. American Tobacco Co., 221 U. S. 106.

The decree, as finally entered, under the authority of the decision just mentioned, fixed the price at which the American Cigar Co. should sell its holdings in Federal Cigar Co., the price at which P. Lorillard Co. should sell its share in American Snuff Co., the price which American Tobacco Co. should charge Liggett & Meyers Co. and P. Lorillard for specified assets, brands, and good-will, and throughout the entire decree, other directions of similar character, in most minute detail were made in respect to many of the defendants, and many of their contracts and property rights.

In U. S. v. du Pont, 188 Fed. 127, defendant was directed to organize additional corporations, furnish them with cash working capital and facilities, transfer properties, facilities, information, etc.

In U. S. v. U. P. Railroad, the decree went into detail concerning shares of other corporations owned by it, the parties to whom they should be sold, the price to be paid, etc.

In many other cases, the decree finally entered upon decisions of the Supreme Court of the United States goes into most elaborate details of comment and direction.

It is thus seen that not only do the courts take cognizance of violation of specific statutes, but when they find that such violations have seriously affected the public interests, they go into detail in directing how these violations shall be corrected, the public interests subserved, and the people permitted to come into their own. These decisions have been followed repeatedly by the Federal Trade Commission in numerous determinations, and there can be no question but that that commission has jurisdiction to correct the abuses practised and attempted to be practised by this most offensive monopoly.

Minerals Separation, originally incorporated with a capital of £15,000, had its capital increased on at least two different occasions, until at last accounts it had a total capital of £50,000. Minerals Separation American Syndicate had a capital of £52,500, and Minerals Separation American Syndicate (1913), Ltd., had a capital of £250,000. Minerals Separation North American Corporation was incorporated under the laws of Delaware, having a capital stock without par value, but inasmuch as it was organized practically for the purpose of taking over Minerals Separation American Syndicate (1913), Ltd., it very probably did not have a capital much larger than the concern which it absorbed. At all events, the total capitalization of the companies interested in the process patents probably does not exceed £500,000; but in order to be on the safe side, let us concede that these interests have a total capitalization of one million pounds, or five million dollars. It certainly is fair to assume that a considerable portion of this capital represents an estimated value of patent rights, as distinguished from actual money invested.

In the issue of the 'Journal of Commerce and Commercial Bulletin' of November 28, 1917, Minerals Separation published a paid advertisement, which among other things said:

"In North America and principally in the United States it is estimated that over one million tons of ore were treated by the process during 1914, 5,000,000 during 1915, and 25,000,000 during 1916, and that more than 50,000,000 tons will be treated during the present year. Great tonnages have been and are being treated in South America and Australia."

In the answer filed by Minerals Separation North American Corporation in the proceedings before the Federal Trade Commission, it is affirmatively alleged:

"That it (Minerals Separation North American Corporation) and its predecessors in title, have granted upwards of one hundred licenses in the United States that are now in full force and effect, and that the aggregate tonnage of ore milled and in part treated under said licenses is in excess of 28,000,000 tons per year."

Applying to this 28,000,000 tons the estimate made by Mr. Hoover that the average is 25c. per ton, we have an annual income of $7,000,000 on a total capitalization which cannot exceed $5,000,000.

Apply the same factor to Minerals Separation, Ltd.'s. own estimate for 1917, made when there was no incentive to minimize and boasting was not necessary and we have the very tidy little profit of $12,500,000, or 250% per annum on the highest possible estimate of capital investment.

Even in these days of high costs, this would seem to be a wholly unwarranted profit wrung by the owners of the process patents from the mining industry.

It is hoped that the Federal Trade Commission will conclude to inquire into the amount of capital actually invested, the life of the original patents, and the probable tonnage to pay royalties, and then fix for Minerals Sep-

...patent and its subsidiaries a rate of license-charge which will permit a fair return and no more upon such capital invested. Of course, in this connection the duration of the patent monopoly under the law is an important item and an element which must have a controlling influence. At the same time, the efforts which have been and are being made to establish a monopoly which shall have a duration beyond the statutory limit of patent-right should be resisted, and the scheme for laying a perpetual tribute on the mining industry should be frustrated.

Resolution adopted by the American Mining Congress in convention at St. Louis on November 21, 1919.

Whereas, on November 12, 1918, the Federal Trade Commission commenced a proceeding against Minerals Separation, Ltd., its subsidiaries and its agents, charging them with stifling and suppressing competition, and monopolistic and oppressive practices, and violations of the Clayton Act and the Federal Trade Commission Act, in that their contracts and methods have tended (*a*) to prevent independent inventors and independent manufacturers from licensing and selling independent processes and independent apparatus, and (*b*) to prevent mine operators from using independent processes and independent apparatus, and (*c*) to require independent inventors and independent manufacturers to pay to Minerals Separation, Ltd., its subsidiaries and its agents, exorbitant commissions as the condition of licensing and selling their own processes and apparatus, and (*d*) to discriminate unfairly, as between manufacturers and inventors similarly situated, in respect to the commissions thus exacted by Minerals Separation, Ltd., its subsidiaries and agents, (*e*) to compel mine operators, metallurgists and engineers to surrender their own inventions to Minerals Separation, Ltd., its subsidiaries and its agents, and (*f*) to prevent mine operators, metallurgists, and engineers from publishing data regarding flotation, and (*g*) to compel mine operators, metallurgists and engineers to withhold information regarding flotation in event of litigation, and (*h*) to exact from mine operators an exorbitant royalty for the use of the processes of Minerals Separation, Ltd., its subsidiaries and its agents, and (*i*) to exact from mine operators royalties upon the use of processes and apparatus in which Minerals Separation, Ltd., its subsidiaries and its agents, have no rights whatsoever, and (*j*) to discriminate unfairly, as between mine operators similarly situated, in respect to the royalties thus exacted by Minerals Separation, Ltd., its subsidiaries and its agents, and (*k*) to disparage, falsely and maliciously, independent processes and independent apparatus, independent inventors and independent manufacturers and the users and patrons of such independent processes, independent apparatus, independent inventors and independent manufacturers, and (*l*) to claim, falsely and maliciously, exclusive rights in excess of those actually possessed by Minerals Separation, Ltd., its subsidiaries and its agents, and (*m*) to threaten, with malice, patent infringement suits based upon claims of exclusive rights exceeding those actually possessed by Minerals Separation, Ltd., its subsidiaries and its agents, and (*n*) to intimidate and coerce mine operators to refrain from using or patronizing independent processes, independent apparatus, independent inventors and independent manufacturers by threatening to withhold from such mine operators licenses under Minerals Separation processes and apparatus, and (*o*) to coerce independent inventors and independent manufacturers, through the tactics above described, to enter into oppressive agreements with Minerals Separation, Ltd., its subsidiaries and its agents; and

Whereas, the American Mining Congress has already filed with the Federal Trade Commission a brief upholding the Commission's jurisdiction in its proceedings against Minerals Separation, Ltd., its subsidiaries and its agents, and the Special Counsel of the American Mining Congress, in his masterly report before this convention, has made clear that the mining industry of the United States, now and for all future time, will be in bondage to Minerals Separation, Ltd., its subsidiaries and its agents, unless the proceeding brought by the Federal Trade Commission is prosecuted to a successful conclusion; now, therefore, be it

Resolved, by The American Mining Congress in convention assembled, with members and representatives present from every mining State in the Union, That The American Mining Congress hereby endorses and commends the proceedings of the Federal Trade Commission against Minerals Separation, Ltd., its subsidiaries and its agents, and endorses and approves the action of the officers and the Special Counsel of The American Mining Congress in supporting the Commission's proceedings; and be it further

Resolved, That The American Mining Congress hereby pledges the assistance of its officers, its special counsel, its Chapters and its members to assist the Federal Trade Commission in its proceedings to terminate the intolerable bondage which Minerals Separation, Ltd., its subsidiaries and its agents, have now imposed, and hereafter in perpetuity threaten to impose, upon the mining industry of the United States.

Twenty-five gold-lode mines were operated in Alaska in 1918, according to the U. S. Geological Survey. There was also a production from seven prospects—abandoned mines or small mines that were not in regular operation. The value of the lode-gold output decreased from $4,581,453 in 1917 to $3,473,317 in 1918, owing partly to the disaster at the Treadwell mine in April 1917, and partly to curtailment of operations, especially in the Juneau district, because of shortage of labor. South-eastern Alaska, especially the Juneau district, is still the only centre of large quartz-mining operations in the Territory. The production in the Fairbanks district decreased materially, as the lode-mine owners of Fairbanks are still awaiting the cheapening of operating costs, especially of fuel, which is expected on the completion of the Government railroad. In 1918 the average value of the gold and silver contents for all silicious ores mined was $1.70.

A Question of Boundaries

By ARTHUR J. HOSKIN

In the district court at Leadville there has just been tried a case involving the early history of mining in Colorado. Discussions in the case have covered the whole existence of the State; they have even antedated statehood.

In November 1861 the Territorial legislature passed a statute defining the boundaries of the original 17 counties in the proposed state of Colorado. Until comparatively recently no serious controversies have arisen relative to these boundaries and the present trouble would not have arisen except for the discovery, a few years ago, of a remarkable deposit of low-grade molybdenite ore in the central part of the State. During the Great War this deposit received intensive exploitation, large mines were developed, and several large concentration mills were erected.

The orebodies occur as shoots in an eruptive sheet outcropping along the continental divide between Leadville and Kokomo. For years it was assumed that the flag-station of Climax at Fremont Pass on the Blue River branch of the Denver & Rio Grande railroad was also upon the line between the counties of Lake and Summit. The molybdenum mines and mills are close to Climax. When the location and patenting of mining claims became an active issue as a result of the molybdenum boom, controversy quickly arose between these two counties as to the possession of this mineralized zone. Among matters annoying to locators was the fact that the two counties permit lode-locations of unequal maximum widths, Summit county being one of the four counties in the United States that continue to limit the width of a lode-claim to 300 ft. Then there has been uncertainty as to where official records should be filed. The county officials were concerned chiefly over the collection of taxes.

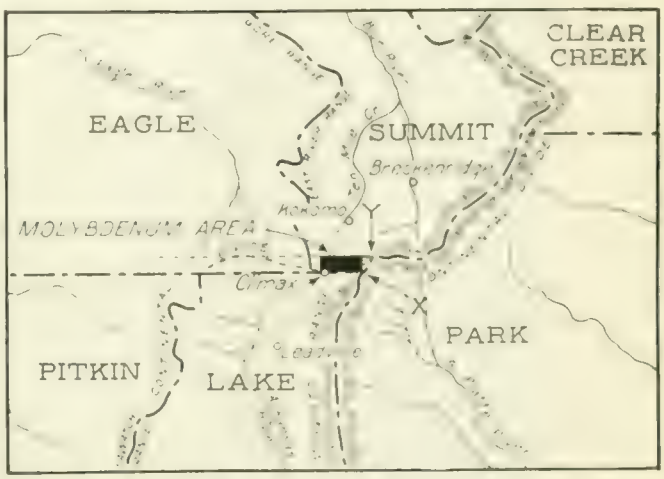
The statute of 1861 defined the boundaries of Park, Lake, and Summit counties as follows, such portions of the descriptions as have no bearing on this issue being omitted:

Park County. Commencing at a point where the second correction line south intersects the Platte river; thence west to the summit of the snowy range east of the Arkansas river; thence in a northerly direction along the divide between the Arkansas and Platte rivers, and around the head waters of the Platte river and its branches; thence easterly along the snowy range dividing the waters of the Platte from the waters of the Blue, to the point of intersection with the first correction line south; to the place of beginning.

Lake County. Commencing at a point on the summit of the snowy range, at the north-west corner of the county of Park, and running due west to the western boundary of the Territory; thence east on the northern boundary of said (Fremont) county to the summit of the range dividing the waters of the Platte and Arkansas rivers; thence northerly on said summit to the place of beginning.

Summit County. All that portion of the Territory bounded on the south by the county of Lake, and on the east by the summit of the snowy range, and on the north and west by the Territorial boundary.

Lake and Summit counties were originally very large, although each is now relatively small. Numerous counties have been carved from all the original counties of Colorado. It appears that the legal boundaries of practically every county in the western part of the State hinge upon a geographical point stated in the statute as



MAP OF PART OF COLORADO

"the north-west corner of Park county". Any change now in the locus of the line between Lake and Summit counties would involve the dividing line between Lake and Eagle counties, Pitkin and Eagle counties, Pitkin and Garfield counties, and Mesa and Garfield counties. Garfield and Mesa counties are west of the limits of the accompanying map. A decision in the present case in favor of Lake county will provide endless business for members of the legal fraternity.

It is strange that such a controversy could arise—that it could attain the dignity of an important lawsuit—when the dispute rests solely upon the identification of a great natural landmark or geographic point. The statute specifies the northern boundary of Lake county as a due-west line starting at the north-west corner of Park county and extending to the Territorial boundary. The law does not say that the boundary line follows the crest of any ranges. Where, then, is the north-west corner of Park county?

Most persons, looking at the map, would declare offhand that the north-west corner of Park county is the

western extremity of the east west line forming its northern side; but this view of the matter is so obviously at odds with the intent of the framers of the statute that this position has been disregarded by both sides in the dispute. This suit was brought by the commissioners of Lake county against the commissioners of Summit county. A suit is now pending between the commissioners of Lake and Eagle counties.

The law mentions the line between Park and Lake counties as the summit of the range dividing the waters of the Platte and Arkansas rivers. This is now known as the Mosquito range, a lofty spur of relatively late geologic time and terminating in the continental divide at the point X on the map. Witnesses and experts for Summit county were unanimous in contending that the point X—which is Mt. McNamee—is the only geographic point that can satisfy the statute as "the north west corner of Park county". Mt. McNamee is the vertex of three large watersheds—the Platte to the south-east, the Arkansas to the south-west, and the Blue to the north.

The Lake county experts placed this corner at Y, basing their contention solely upon an interpretation of the phraseology in the old statute: "and around the headwaters of the Platte river and its branches" and insisting that this clause describes a portion of the westerly side of Park county. Just why a corner was decided upon at Y, an un-named peak, instead of some other peak farther to the north and east in the continental divide was not made obvious during the trial. Lines projected westward from X and Y enclose the molybdenum area shown in solid black on the map. The case summers down to a dispute concerning two points that are more than one and a half miles apart. The State Engineer of Colorado surveyed the line from Mt. McNamee and this starting-point was never doubted by anyone until the present argument arose about three years ago. It is possible that the pioneer law-makers of Colorado were not sufficiently precise in their descriptions of county boundaries; if so, we may allow them the excuse that this region was then an unsettled wilderness, the geography of which was not well understood.

The case was tried by Judge Henry J. Hersey of Denver. Among the witnesses for Lake county were J. M. Kleff, George H. Heitz, Howard W. Platt, Ross R. May, and Douglas Platt, all mining engineers of Leadville. The witnesses for Summit county were Victor G. Hills and Arthur J. Hoskin of Denver; William H. Lea, surveyor for Eagle county, James D. Galloway, surveyor for Summit county; W. H. Powless surveyor for Park county, and Fred J. McNair, surveyor for Lake county. The decision in this case was made September 30 by Judge Hersey. William C. Robinson, attorney for Summit county, immediately requested a new trial and is given thirty days in which to file his reasons. The attorney for Lake county was John A. Ewing.

Most mines on the Rand are comparatively dry, but in recent years a large amount of water has been used for allaying dust, which has required the use of elaborate pumping plants.

Gold and Silver

*Silver production for the United States in 1918 amounted to 67,810,139 oz. Production has been gradually decreasing since 1915 when it amounted to 74,961,075 oz. At that time the average price of silver was 50.7 cents whereas in 1918 the average price was $1 per ounce. A table comparing prices and production since 1912 follows:

Year	U. S. Production Oz	Average Price $
1912	63,766,800	0.615
1913	66,801,500	0.604
1914	72,455,100	0.553
1915	74,961,075	0.507
1916	74,414,802	0.658
1917	71,740,362	1.324
1918	67,810,139	1.00

Although silver has increased in value at the average rate of about 16⅔c. per year for the past three years it would seem to have had little influence on increased production. The output of silver is greatly influenced by the production of the base metals copper and lead. Roughly 40% of the output of the western hemisphere (which in turn produces about 80% normally of the world's output of silver) comes as a by-product in the mining and reduction of those base metals. Any condition affecting the latter will make itself felt in the silver market. It would appear that improvements in base metal milling and mining operations are more to be looked to in increasing the production of silver, coupled with further discoveries of new ore deposits, than an increase in the price of silver itself. The drastic decrease in copper production during the early part of the current year in this country, the almost incessant labor unrest in the copper, silver, and lead industries, and the strikes in the important silver-mining districts on this continent, point to a substantial decrease in current yearly production.

Gold production for 1918 shows a decided drop from 1917 in the United States. From 1913 to 1917 the production has averaged annually about 4,450,000 oz. Last year the output amounted to 3,313,373 oz.; in 1916 it was 4,479,056 and in 1917, 4,051,440 oz. There is little stimulus to increased production of gold, the added cost of materials and labor forcing many projects to be abandoned. In the case of inactive mines a re-opening is usually costly and may entail considerable unwatering, re-timbering, and extra labor. Over $100,000,000 worth of gold has been shipped to the Far East since the embargo in the exportation of gold was lifted on June 1. Considerable gold has also found its way to South America to strengthen the exchange-rate between the United States and countries on that continent. There is an increased demand for gold and silver products in the arts. Gold production on the Rand in South Africa has been somewhat below normal; during August 1919 it was 706,000 oz., and the month previous 725,000 ounces.

*Excerpts from monthly reports on minerals investigations of the U. S. Bureau of Mines.

REVIEW OF MINING

FROM OUR OWN CORRESPONDENTS IN THE FIELD

ARIZONA

CURTAILMENT AT COPPER QUEEN.—COAL SHORTAGE.

Douglas.—The Copper Queen reduction works of the Phelps Dodge Corporation has practically completed arrangements for reduction in its production, recently decided upon. Tonnage of Copper Queen ores has been reduced to supply approximately 5,000,000 lb. per month. Moctezuma Copper Co., at Nacozari, will supply about 2,000,000 lb., and custom ore about 500,000 lb. This is a reduction of about 1,500,000 lb. from the November output. A furnace and one converter were closed down. That no further reduction in output or number of employees is expected to be made at this time has been learned from authoritative sources. The company, in discharging the few men who had to be let go, observed its usual rule by holding heads of families in preference to single men. The C. & A. company also has begun reducing production, but to what extent has not been stated officially.

Jerome.—James S. Douglas, president of the United Verde Extension Co., reached here December 3, having come for the purpose of attempting to borrow coal from other operators in the district, in sufficient quantity to supply the power-plant of the smelter until oil-burning apparatus could be installed under the boilers. If this could not be done, Mr. Douglas said, it would be necessary to close down the property for a time, throwing a number of men out of employment. United Verde Extension had been obtaining its supply of coal from the Gallup, New Mexico, district which is producing no coal at present.

A VIEW OF THE L. V. X. MINE, SHOWING THE CONTACT OF THE DARK BASALT AGAINST THE WHITE LIMESTONE

Other mining properties in Arizona are similarly threatened, it is stated, but many of them have installed oil-burners and will be able to continue as long as the railroads run.

Courtland.—Diamond-drilling may solve the development problem of the Courtland district, the ups and downs of which have been noteworthy in the mining world, for the last 10 years. By use of a diamond-drill the Great Western Copper Co. has outlined a body of copper ore said to be of large extent and its three-compartment shaft is now entering this ore-zone at 350 ft. The shaft has already penetrated the ore between four and five feet. Such favorable results were obtained by

diamond drilling that a prospect shaft which had been sunk to the depth of 200 ft. has subsequently been enlarged to a three-compartment shaft. It has been decided to sink this to the depth of 500 ft., which will be the deepest working in the district. Lack of depth has been the greatest handicap under which the Courtland district has labored hitherto, in the opinion of many people who have watched it carefully. The Great Western strike is of importance as giving encouragement to the hope for better things to follow. Courtland was the scene of a historic rush about ten years ago.

Tombstone.—The Solstice Mining & Milling Co., better known locally as the Winter's mine, has been sold to Will T. Boyd and associates for a price said to range well into the thousands. Steps will be taken by the purchasers in the immediate future to put the mine in operation. The Solstice formerly was a producer and is said to have considerable silver ore of shipping grade, while there is evidence, in surrounding properties, of continuity of the orebodies at depth.

Bisbee.—The Shattuck-Arizona mine is speeding up production of lead-silver ores, which are being handled by its mill at the rate of 300 tons per day. A slight improvement has been made in recovery so that the mill now shows a small profit per ton on all ore handled.

MICHIGAN

PRODUCTION FIGURES FOR NOVEMBER.

Houghton.—The close of navigation came suddenly the first week in December. There is more copper on the docks and in storage in the various smelter warehouses, than at any previous time during the past 20 years. The situation was relieved considerably just before the ice formed in the harbor. On the day before the lake froze over, all the copper of the Michigan, Wolverine, and Mohawk corporations was shipped out on hurry-up orders from the eastern office. Much of this copper was sold for foreign shipment. In addition to this accumulated output of the so-called Stanton mines, the Copper Range companies made some important shipments by water to the East on November 20. This included a large German shipment. The Stanton and Paine mines are practically 'cleaned up' of metal, and the Quincy is in better shape than 30 days ago, by a considerable amount. None of these properties stood its share of the curtailment program which went into operation in this district last spring.

Production of copper from the mines of the Lake Superior district for November was about the same as for October. In fact, a preliminary survey of the situation indicates practically no change in either the total output or in any of the individual mines. The Osceola Consolidated output from the Old Osceola and the North Kearsarge branch was 59,000 tons of ore, running 16 lb. per ton, so that the refined output will be more than 900,000 lb. compared with 936,252 lb. in October and 849,100 lb. for September. Ahmeek produced 69,000 tons of ore in November, compared with 68,000 tons in October, but it is doubtful if the yield will be 24 lb. per ton, which was an average increase of 2.2 lb. over September. Isle Royale handled 65,000 tons, a slight decrease as compared with October. Isle Royale's average yield will reach 20 lb. per ton if the present improvement continues. This is creditable to the management, for the mine was operating on a basis of 13 lb. in 1916, 14.6 in 1917, and 15.9 in 1918. Allouez produced 18,000 tons in November, Centennial 7000, Mass Consolidated 14,000 with a considerable showing of mass and barrel copper. La Salle and Superior sent down just a few cars taken out in development. Hancock is gradually increasing its working force. Three additional drills started last week. Seneca is not yet shipping. Regional, divisional, and national officials of the railway service are being importuned constantly by mine officials to get a rate sufficiently low to permit ore shipments.

NEVADA

DEVELOPMENT AT DIVIDE.—NEW CONSOLIDATION OF GOLDFIELD PROPERTIES.

Divide.—The Belcher Extension at a depth of 30 ft. in a prospect shaft being sunk near the Thompson boundary line has opened ore reported to assay $814 for a 10-in. width, $340 for a 2-ft. width, and for a second 10-in. width, $644. At 35 ft. the assays were: 26 in., $420; 10 in., $930; 8 in., $1590. The discovery is regarded as one of the most important ever made in this district, as sampling of the vein at the surface during the period of the labor trouble indicated the existence of an ore-shoot with a possible maximum length of 1000 ft. and a minimum of 500 ft. Trenching and sampling on a large scale gave good assay returns for widths of from a few inches to 4 ft. over a distance of 500 ft., 300 in the Belcher Ex., and 200 in the Belcher, with additional sampling giving lower returns for another 500 ft. The vein strikes almost due east and dips south at 60° in the Belcher Ex. It is reported that the vein has been entered by a cross-cut from the bottom of the 200-ft. Caldwell shaft of the Divide Extension and an announcement to this effect by the management is expected in a short time. The cross-cut being driven by the Dividend at a depth of 75 ft. in the new shaft, near the Divide Ex. line, has entered the extension of this vein and a drift is being driven to open the ore-shoot. The Victory, at a depth of 230 ft., has cut the vein striking south-west into the Butte; thus far only unimportant assays have been secured. This vein crosses the main ore-channel of the district, in which the rich ore was found in the Belcher Ex.

Arrowhead.—The ore-shoot in which the east drift on the 100-ft. level of the Arrowhead is being driven, has widened to 8 ft., the average tenor for this width being $100, with seams assaying as high as $2000. A drift on the 175-ft. level is close to this shoot. Other companies are starting work rapidly and a number of shafts are nearing points from which lateral work will be started. This district is attracting wide attention in the southern part of the State and a town is growing rapidly.

Goldfield.—The Red Lion, Desert Chief, and New Goldfield Sierra properties, long inactive, have been con-

solidated with the Yellow Tiger, which is now preparing to levy an assessment for funds to resume work. Interested in the deal are H. G. McMahon and A. L. D'Arcy of the Goldfield Development Co. who, with H. A. Riedel former president of the Yellow Tiger, will be directors in the new organization. The Yellow Tiger now owns 350 acres in the district, 135 of which are practically contiguous in the southern part. There is a 772-ft. shaft on the Jackass group, the main Tiger claims, and a large amount of development work was done before the company discontinued work 10 years ago. At that time small shoots of ore were exposed on the 700-ft. level that assayed as high as 14% copper, 16 oz. silver, and 0.48 oz. gold. The vein at this depth is 70 ft. wide, the ore being found on the hanging wall. The surface of the entire

ELECTRIC HAULAGE IN A MICHIGAN COPPER MINE

acreage will be prospected before work is resumed, and a new shaft may be sunk at a point from which the Jackass and Red Lion groups can be developed economically. The present shaft is 1400 ft. from the Red Lion line. This is the most important transaction in the district since the Development company was formed and the Florence changed hands, as it promises the exploration of territory far outside the proved zone. The production of the Florence for 1919 will be $252,000, according to preliminary estimates by E. A. Byler, engineer for the company. From July 1 to October 1 the Florence Divide lease shipped $129,741 worth of ore; the production to date has been over $174,000, the latter figure being based on eleven additional 45-ton shipments since October 1, which were not included by Mr. Byler. Five feet of ore, 20 in. of which assays $39, with the remainder assaying $20, has been opened in a 15-ft. raise on the 815-ft. level of the Grandma. This is the widest shoot found in the Grandma since work was started. From 12 to 14 in. of ore reported as assaying from $3200 to $6300 has been opened on the 250-ft. level of the Combination mine of the Development company at a point midway between the Combination shaft and the Florence line. Next to the rich seam is another, 18 in. wide, that assays $17. The ore has been followed for only a short distance.

SIMON DISTRICT.—A number of companies that started work at the height of activity in the district have suspended operations. This includes the West Extension. A cross-cut from the bottom of the 280-ft. shaft of the Simon Mina has been driven 75 ft. toward the main vein of the district and is expected to cut the vein within an additional 60 feet.

PIONEER.—There is 75,000 tons of ore of an estimated grade of $12 per ton blocked out in the Mayflower, according to J. B. Kendall, manager for the company. Development work is being done on the 200, 300, 400, and 500-ft. levels. The main north drift on the third level has been driven 1000 ft. and it is estimated that it will enter an important ore-shoot during the course of the next 200 ft. The mill for the first time is treating ore at the rate of 50 tons daily. Mr. Kendall estimates the value of the monthly production of the mill at from $8000 to $10,000, with the net at from $4000 to $5000.

ROUND MOUNTAIN.—Tonopah and Goldfield men have optioned the Silver Shield, in Horse canyon, six miles north-east of Round Mountain, for $50,000 and have made a first payment of $5000. The mine has been worked for many years, at one time by Mexicans, the principal development being a 200-ft. shaft and a 400-ft. drift-tunnel, both in a porphyry hill. The greatest depth of the tunnel is 160 ft. and, according to Dr. J. L. McCarthy of Goldfield, one of the holders of the option, the ore-channel at this depth is 22 ft. wide, the silver ore being of milling grade. Several cross-cuts, four raises, and a winze expose the vein, the bottom of the winze, 40 ft. deep, being in rich ore. The ore contains stephanite,

with rich seams in chloride form and a small gold content. The lowest assay secured from a large dump at the entrance to the tunnel was 20 oz. silver.

UTAH

COAL MINERS' WAGES INCREASED.—UTAH COPPER DIVIDENDS.—NOTES.

SALT LAKE CITY.—Notices announcing an average increase of 14% in the wages of all Utah coal miners and employees of coke ovens were posted November 29, according to A. D. Pierson, general sales agent of the Utah Fuel Co. Speaking in behalf of the Utah coal operators, Mr. Pierson said that this advance in wages will increase the average cost of producing coal from 25 to 30c. per ton, and means an increase of between $1,250,000 and $1,500,000 per year in the payrolls of Utah coal-fields. The coal operators are obliged to absorb this wage advance, as the Federal Administration will not permit them to add anything to the present Government price of coal. The prices at the mines, established by the Fuel Administration, are $3.65 per ton for screened or prepared sizes, $3 for mine run, and $1.85 for slack. The Utah coal operators have always prided themselves on maintaining good wages and satisfactory working and living conditions in and around their mines. The operators are unanimous in paying tribute to the loyalty of their men, who remained at work during the recent strike, thereby performing a most important public service. The increase in wages just made, without any increase in the price of coal, will be a heavy burden, even for the strongest producing companies. There is no way in which the operators can, to any appreciable extent, offset this increase in cost of production, except through an increase in the efficiency of their employees.

At the quarterly meeting of the directors of the Utah Copper Co., held in New York City on December 2, a dividend of $1.50 per share was declared, payable December 31. With the close of the current year, dividend disbursements by the Utah Copper will have passed the one-hundred-million dollar mark. Since its initial dividend on September 30, 1908, this company has distributed the following amounts to its stockholders:

Year	
1908	$ 696,387.50
1909	1,464,387.50
1910	4,648,675.00
1911	4,703,022.00
1912	4,729,747.50
1913	4,747,710.00
1914	4,827,885.00
1915	6,904,082.50
1916	19,493,880.00
1917	23,555,105.00
1918	16,244,900.00
1919	9,746,940.00
Grand total	$101,762,722.00

The cold wave which hit Utah on November 26 gave the Utah Power & Light Co. considerable trouble and interfered with mining and milling operations. Mush-ice in the streams in Idaho and Utah made it impossible for the plants of the company to generate the usual amount of power on November 26 and 27. Among the milling plants affected in this vicinity was that of the Utah Copper Co. at Arthur, which was forced to curtail operations almost 50% for nearly 24 hours.

Walter Fitch, Jr., the Tintic mining contractor, left Salt Lake City on December 3 in company with Murray C. Godbe, general manager for the Prince Consolidated Mining Co., for Pioche, Nevada, to size up a contract for sinking a new shaft contemplated by the Prince company. Diamond-drill operations have revealed good ore deposits at depth. Mr. Fitch put down the first 400 ft. of shaft and the Prince Consolidated company is now sending the shaft down an additional 500 ft. The water-level in the mine has just been reached, and Mr. Fitch will look over the work with a view to taking a contract to sink 400 ft. of shaft from the water-level.

PARK CITY.—Shipments from this district for the week ending November 29 totaled 1698 dry tons, of which the Silver King Coalition shipped 549 tons; the Ontario Silver, 494 tons; the Judge M. & S., 340 tons; the Daly West, 145 tons; the Silver King Consolidated, 110 tons; the Naildriver, 55 tons; and the New Quincy, 6 tons.

M. J. Dailey, general manager for the Silver King Coalition, has been at the property throughout the week. Several important discoveries have been made in new territory, and prospects for increased production were never better. It is understood that portions of the mine abandoned by former superintendents are being cleaned out and re-timbered. Forrest Mathez was recently appointed superintendent.

On December 1 another shift was put on at the mine of the Judge Mining & Smelting Co., according to O. A. Friendly, superintendent. This means that the output will be practically doubled. This announcement will put to flight recent rumors that the ore was 'pinching out' in this old-time producer. The employees of the company are increasing the volume of their orders for foodstuffs, under the plan, recently introduced by the management, of purchasing carload quantities of supplies, which are sold to the men at cost, thus offsetting some of the recent rise in prices.

ALTA.—As is the case at most of the properties in this district, operations at the Columbus-Rexall mine have been slowed down by the inclement weather, which set in unusually early this year. Sufficient snow has fallen to spoil the roads for wagons, but not enough to make it possible to haul ore and mining supplies with sleighs.

EUREKA.—Shipments from the mines of the Tintic district for the week ending November 29 totaled 150 cars. While slightly less in volume as compared with the previous week, this shows that the mines here are maintaining the increased rate of shipments of the past few weeks. As usual, the Chief Consolidated heads the list, with Tintic Standard second. The mines shipping and number of cars for this week are: Chief Consolidated, 40; Tintic Standard, 27; Dragon Consolidated, 12; Colorado, 12; Iron Blossom, 12; Mammoth, 9; Centennial Eureka, 8; Eagle & Blue Bell, 8; Grand Central, 7; Bul-

lion Beck, 2; Gemini, 2; Ridge & Valley, 2; Sunbeam, 2; Victoria, 2; Gold Chain, 2; Utah Con., 1; Empire Mine, 1; and Swansea, 1.

Operations at the Eureka Bullion mine are proceeding satisfactorily. The winze on the 800-ft. level, which is being sunk at the rate of approximately 80 ft. per month, is now 110 ft. deep. The objective of the winze is the intersection of an east break which dips about 85°, and a west break with a 75° dip. It is the intention of the company to use this winze for depth operations.

The face of the May Day drift is being advanced rapidly by the contractors, according to George H. Dern, manager of the property. This drift, being driven from the 1800-ft. level of the Yankee shaft, is in a favorable lime formation. Approximately 750 ft. of the distance remains before the objective of the drift, an extension of the May Day shoot that produced heavily in the upper workings, will be cut. Close to 250 ft. of driving has been done in a period of slightly over a month.

BINGHAM.—Production at the Utah-Apex is being steadily increased, and has now reached 500 tons per day. According to present plans, officials expect to have the output up to 1000 tons per day some time during the early part of the coming year. The product from the mine averages 12% to 14% lead, and also carries considerable silver. With lead at 6¾ to 7c. per pound and silver around $1.30 per ounce, earnings are excellent. Operations are still handicapped by a shortage of experienced miners.

WISCONSIN

REVIEW OF THE ZINC, LEAD, AND PYRITE INDUSTRIES FOR NOVEMBER.

Ideal conditions from an operating standpoint during the month of November failed to stimulate production in the Wisconsin field, low markets and high costs no doubt contributing toward a conservative mining program. A noticeable cause for complaint with all operators was found in the scarcity of shovelers, although a scale of prices has been established enabling good men to earn as high as $6 to $7 per shift. One of the larger operating groups introduced a system of 'Industrial Democracy',

GENERAL VIEW OF THE TOWN OF BINGHAM CANYON, SHOWING THE MINE OF THE UTAH COPPER CO. IN THE BACKGROUND, AND THE BINGHAM & GARFIELD RAILROAD IN THE CENTRE

and savings on cost of production, through intensive individual effort, were distributed among men engaged 13 consecutive shifts. This, with the additional bonus of 1c. per 'can', for shovelers of all classes, working six consecutive shifts, enabled the men to earn as high as $35 to $45 per week.

Prices for zinc ore have been steady, although not entirely satisfactory to shippers. The base on prime western blende at the beginning of the month stood at $50 per ton, continuing at this level until the third week, when an increase of 50c. per ton was announced. The closing days of the month found the base for premium blende quoted at $51.50 per ton, 60% zinc, on which base zinc ore recovered at the local reduction plants would be commanding a price of nearly $55 per ton. Second-grade zinc ore was in better demand toward the close of

the month, and shipments of run-of-mine ore showed considerable improvement. Low-grade zinc-ore producers fared indifferently the greater part of the month, quotations running from 60c. to 70c. per unit of zinc. The reserve in the field is: milled ore, 6000 tons; high-grade refinery ore at separating plants, 2200 tons.

Lead-ore production made appreciable gains during the month, mainly on account of the richness of the lode at the Big Dick mine, in the Cuba City district, where the mill output runs from 10 to 20 tons daily. This was also true of exclusive lead-ore producers at several points in the field, most of the lead concentrate being carried over. Price offerings were good all month beginning at about $80 per ton, 80% lead content, and advancing the first half of the month to $82 per ton. The second half of the month witnessed a smart advance, foreign quotations going to $88 per ton. Local buyers insisted they could not meet this demand on long hauls to smelter and the best price paid in the Wisconsin field was on a base of $85 per ton. Operators profess to see, in the metal-market conditions, the near prospect of higher offerings and prefer to hold their ore awaiting developments. The reserve in the field at the end of November is conservatively estimated at 1200 tons.

The recovery of pyrite at separating plants continued in proportion to the tonnage handled. While conditions in the acid market showed some improvement, the better tone was not communicated to local ore markets and shipments for the month were of an indifferent nature, one of the leading establishments long actively engaged in marketing this class of ore retiring entirely. The reserve increased at all of the refining plants, and at the close of the month is considerably in excess of 5000 tons.

Better prices all month for carbonate zinc ore ranging from $27 to $35 per ton, 40% zinc, stimulated deliveries. More than 1900 tons was marketed. This type of zinc ore came entirely from the mines of the Highland district. Independents were given an opportunity to come into the market for the first time in several months but the bids for ore, locally, were not up to the figures given out in the standard publications. Production is not being encouraged until offerings show substantial improvement. A better market for paint pigments afforded an outlet for large stocks of oxide zinc in the hands of smelters and this forward movement, it is believed, will encourage heavier production of carbonate zinc ore in this field.

Deliveries of ore for the month of November, by districts, follow:

District	Zinc, lb.	Lead, lb.	Pyrite, lb.
Benton	12,084,000	336,000	1,402,000
Livingston	4,154,000		
Galena	3,818,000	180,000	
Cuba City	1,976,000	666,000	464,000
Hazel Green	1,202,000		
Highland	1,140,000		
Platteville	572,000		
Shullsburg	532,000		
Linden	342,000		
Dodgeville		54,000	
Total	25,840,000	1,530,000	1,866,000

Deliveries of high-grade refinery ore, from separating plants to smelters, were made as follows:

	Lb
Mineral Point Zinc Co.	5,062,000
Wisconsin Zinc Co	3,882,000
National Zinc Ore Separators	3,000,000
Linden Zinc Co	530,000
Block-House Mining Co.	572,000
Total	13,046,000

The gross recovery of zinc concentrate at mills amounted to 12,920 tons. Net deliveries to smelters from mines and refineries were 8700 tons. Of raw ore deliveries made to refiners direct, the Mineral Point Zinc Co. received 4876 tons; National Separators, 3540 tons; Wisconsin Zinc Co., 2679 tons; Linden Zinc Co., 339 tons. The refinery shipments were: to the Mineral Point Zinc Co., 2531 tons; Grasselli Chemical Co., 1438 tons; American Zinc Co., 1304 tons; American Metal Co., 1297 tons; United Zinc Smelters, 447 tons; Illinois Zinc Co., 167 tons.

BRITISH COLUMBIA

TAXATION OF GOLD MINES.—MEETING OF CANADIAN MINING INSTITUTE.

SKEENA.—The Drum Lummon copper mines will be worked on a considerably larger scale next year, and new equipment will be added to the present plant. Last year the company erected a small concentrating plant and a gasoline-driven compressor, besides doing several hundred feet of development and breaking down a considerable tonnage of ore. During the past season about ten tons of high-grade and concentrate were shipped each month.

GRAND FORKS.—A. E. Savage has been given a contract to drive a 1000-ft. tunnel at the Little Bertha-Pathfinder mine to cut the Little Bertha orebody at depth. Should the tunnel succeed in cutting good ore it will be continued for another 1000 ft. to cut the orebody on the Pathfinder claim. Both these claims produced good ore at the surface several years ago. Capitalists from the United States have taken up the bond on the Union mine, which they acquired earlier in the season. Development work will be carried on during the winter. The force of men at the Molly Gibson has been increased. The ore is being rawhided to the railway over the snow.

KASLO.—The custom concentrator has been closed for the winter through lack of ore to keep it running. A shipment of 77 tons was sent to Trail.

AINSWORTH.—In order to raise funds to meet pressing indebtedness, 200,000 shares of treasury stock is being offered to the shareholders of the Utica Mines, Ltd., at 10c. per share. Last year the company operated for about three months, and produced 220 tons of ore, which gave a return of 13,661 oz. of silver and 10 tons of lead.

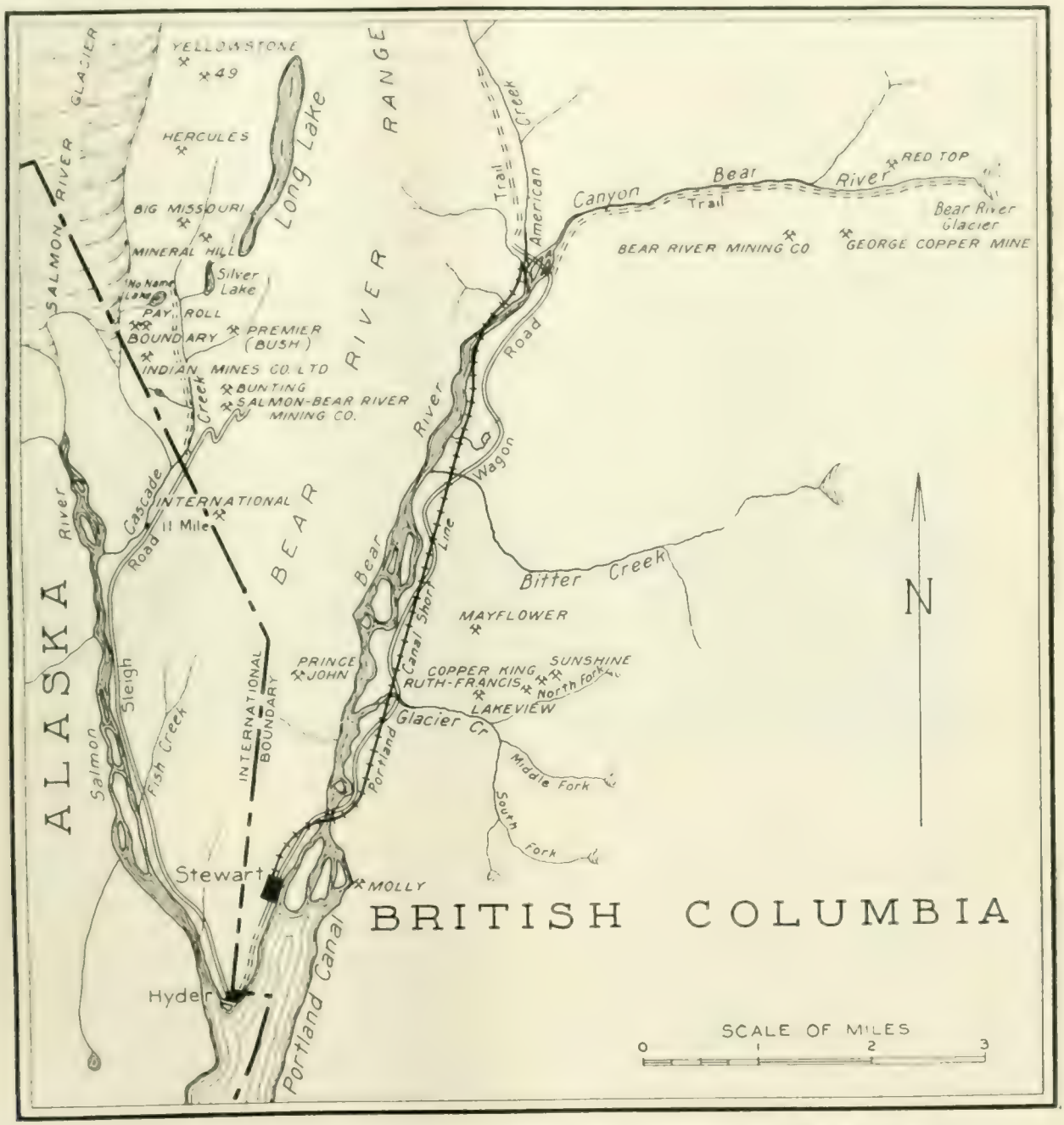
PRINCETON.—The Canada Copper corporation's new boarding-house at Allenby was destroyed by fire on November 26. The loss is $10,000. The cause of the fire is unknown, though suspicion rests on I. W. W. strikers.

NEW HAZELTON.—The Sunrise mine has been bonded

to the Guggenheim interests. The Sunrise is situated on Nine-mile mountain, about one mile from the Silver Standard mine. A considerable amount of surface stripping has been done, exposing a number of veins, varying in size from a few inches to several feet. The mineral matter in these veins is, as a rule, fairly complex, consisting of galena, blende, gray copper, stibnite and in

arranged and, pending the completion of the new copper mill, copper ore will be crushed at the lead mill.

Ore receipts for the week from November 15 to 21 inclusive, at the Trail smelter totaled 4648 tons, the aggregate tonnage for the year to date being 289,816. Of the independent shippers the chief were: Florence, Princess Creek, 153 tons; Josie, Rossland, 318; Mandy, Le Pas,



MAP OF THE SALMON RIVER AND PORTLAND CANAL REGIONS, BRITISH COLUMBIA

some instances molybdenite. The silver content is usually high, while sometimes appreciable quantities of gold occur.

TRAIL.—A recent fire destroyed the copper mill of the Trail smelter. The company now has the necessary repairs in hand and it is announced that the misfortune does not necessitate the suspension of copper ore shipments to Trail for treatment. The lead mill is being re-

Manitoba, 156; Paradise, Athalmer, 41; Rambler-Cariboo, Rambler, 52; Standard, Silverton, 199; Van Roi, Silverton, 41; and Whitewater, Ratallack, 40. The Centre Star mine, Rossland, was the principal shipper of the company properties with 1876 tons while the Sullivan mine, for the first time for weeks, shows a shipment of 259 tons of zinc ore.

NELSON.—Hon. John Hart, Provincial Minister of

Finance was requested, while in Nelson recently, to submit legislation to the Provincial Legislative Assembly at its next session, providing for the amendment of the Taxation Act, in such fashion as to grant a more liberal form of relief to operators of gold mines. Under the Taxation Act of 1918 a gold mine is deemed to be a mine whose gold production amounts to 85% or more of the total value of the output. Mines coming within this classification are exempted from the 2% tax on output in recognition of the unfavorable condition of gold in the market. Representations were made to Mr. Hart that the position of gold now is more unfavorable than it was at the time of the enactment of this legislation and that the advance in silver has made it difficult for any gold property having even a very small proportion of silver in its ore to come within the 85% definition. It was stated as an example that $17 gold ore, containing even 2½ ounces of silver at the present price, fell outside the exempted category, yet the property was essentially a gold property. It was held, as a matter of fact, that very few purely gold properties can operate under present conditions. Mr. Hart was requested to revise the definition of a 'gold property', in order that the class of mines it was originally intended to benefit might come within the classification.

The Utica mine of the Ainsworth division has not been operated for some time, but T. J. Poyntz, formerly superintendent, has not lost faith in the property. In a portion of the old workings he recently made a strike of high-grade silver-lead ore and now is sacking a quantity of the best for shipment. It is not unlikely that some action will be taken to develop this mine further. The Minister of Mines Report for 1918 shows that the Utica was operated for three months in that year, that 222 tons of ore was shipped, and that that tonnage yielded 13,661 oz. of silver and 10 tons lead.

Vancouver.—A company, with a capitalization of $10,000,000, is proposed for the purpose of undertaking in British Columbia the establishment of the plant necessary to smelt and refine all the ores produced in the Province. The enterprise would involve the erection of smelters for treating copper, silver-lead, and zinc ores, producing the refined metals ready for the market, and supplying alloys of the same. It also would include the launching of a commercial iron and steel plant. It is understood that the project is to come before the Vancouver Board of Trade and that, in all probability, the Government will be asked to provide some form of encouragement and support.

The Canadian Mining Institute held its first annual meeting in Western Canada at Vancouver, B. C., from November 26 to 28. Delegates numbering over 200 represented the mining activities of the entire North-West. The program was well diversified. 'Food for thought' was there for those so inclined and entertainment was not lacking. The opening session was presided over by S. S. Fowler, of Nelson, in the absence of R. McDougall, of Nova Scotia, President of the Institute. Utilization of returned soldiers for prospecting was one of the first matters discussed, it being held that the Government, Dominion or Provincial, should employ returned men for prospecting under the guidance of experienced geologists. On Saturday morning the delegates were given an opportunity to visit the Britannia mines or the coal mines of Vancouver island, as well as several other side trips. The majority went through the Britannia, being escorted through the principal workings by a representative of the company. Quite a number, however, took the boat across the Gulf of Georgia to Nanaimo and inspected the chief producing colleries of that coalfield.

ONTARIO

DOME COMPANY FINANCES.—ELECTRIC POWER PROJECT.

Porcupine.—The labor situation, though showing some improvement, is far from satisfactory and the shortage of workers continues to limit the output of all the producing mines with the exception of the McIntyre, which has all the men required. The promise made last summer by J. S. Bache, president of the Dome Mines, that the company would resume dividend payments with the New Year, has been fulfilled by the announcement of a dividend of 25c. per share on January 15, which has been received with much satisfaction in financial circles, as indicating that the gold mining industry is recovering from the economic strain due to the War. During the fiscal year ended March 31, 1918, the Dome Mines operated at a loss of $45,869, which was followed by the closing down of the mill, and when re-opened last spring it was faced by the high cost of labor and material. Matters took a favorable turn early in the summer and a considerable reduction in operating costs was effected. It is anticipated that by the close of the current fiscal year, March 31 next, the company will be able to show a surplus of approximately a million dollars. The Keora has called for tenders for sinking 250 ft. and 500 ft. of cross-cutting.

Kirkland Lake.—During October the Lake Shore treated 345 tons of ore with a production of $5565. The mine has been unwatered down to the 200-ft. level. Equipment is being installed at the Chaput-Hughes preparatory to sinking a shaft.

Matachewan.—Development on the Matachewan (formerly the Otisse) is making good progress, with satisfactory results. One thousand feet of cross-cutting and drifting has been done on the first level, at a depth of 160 ft. and in addition to encountering the veins outcropping on the surface other orebodies have been found. New York interests have secured an option on the Robb-Clemens claims adjoining the Matachewan and a contract has been let for diamond-drilling. Active work has been begun in connection with the scheme for supplying Matachewan and Gowganda with electric power from Indian Chute on the Montreal river. Camps are being built, the power site cleared, and the final surveys of the falls are being made.

Boston Creek.—The shaft of the Miller Independence company is down 350 ft. At a depth of about 250 ft. a new vein was encountered, which dipped out of the shaft.

at 300 ft. Cross-cutting will be undertaken on the 500-ft. level. It is expected to secure electric power by about the end of the year. A steam-driven plant is being installed on the Peerless, where development work has encountered some good ore. The Allied Gold Mines are not operating at present. At the Boston-McCrea diamond-drilling has cut four veins, two of which contain some gold.

Cobalt.—The part of the Chambers-Ferland purchased by the Northern Concentrator Co. consists of 25 acres lying along the east side of the railway, which still leaves the company nearly 100 acres, on which it proposes to carry out an extensive development program. Cross-cutting will be undertaken at the 425-ft. level on a conglomerate area lying between the Nipissing and La Rose properties. The Hargraves is to be re-financed by the formation of a new company capitalized at $2,500,000. Shares of the par value of $700,000 will be retained in the treasury. The Peterson Lake company will recommence development work as soon as unwatering, which is now in progress, will allow drilling to be done on the first level. Funds in hand are sufficient to enable work to be carried on for a year. A quantity of wall-rock left in the Seneca property when silver prices were too low for it to be profitably extracted, will be taken out. The payment by the McKinley-Darragh of a 3% dividend on January 1, calling for the disbursement of $67,428, will bring the total returns to shareholders up to $5,686,735, or 256% on their capital.

AN ORE-SORTING SCENE IN MEXICO

SONORA

RESUMPTION OF OPERATIONS.—NEW TAX ON SILVER EXPORTS.

San Nicolas.—Additional thickeners and another flotation machine will be added shortly to the mill at this property, increasing its daily capacity to approximately 100 tons. At present it is handling between 50 and 60 tons of silver-lead ore daily. The company is making a high-grade concentrate, which is packed as far as Cumpas and hauled from there to Nacozari by wagon. The mine is operated under lease by Douglas, Arizona, people. H. W. Kaanta, mill superintendent, has just returned after making arrangements at Nogales for the delivery of the additional machinery late in December or early in January.

Buena Vista.—The Buena Vista mine, operated by H. J. Wendler and H. Barney, has completed its cupeling furnace and soon will be shipping its product to the refinery in the form of a high-grade silver-lead matte.

Mina Mexico.—This property has re-opened for operation after approximately four years idleness, caused by revolutionary disturbances. Following an inspection made by E. P. Ryan, general manager of the mining interests of the Potter Palmer estate of Chicago, and C. D. Cline, consulting engineer, it was decided to erect a 50-ton flotation plant. Delivery of equipment will be made shortly after the first of the year. In the meantime, pack-trains and wagons to transport the machinery to the mine, about 30 miles east of Suaqui, are being obtained. The machinery will be shipped to Nacozari by rail, and hauled by wagon or packed on mules to the property. Although it had been closed for a considerable period, the property was found to be in excellent condition and but little preparatory work underground will be necessary.

Agua Prieta.—A Federal decree specifying increased silver taxes, based upon the silver content of all ore or bullion presented for export at any port in Mexico, has been received here. The rate of taxation is on a sliding scale, depending upon the market price of the metal. When silver is $1 or less per ounce, a tax of 7% is to be assessed. From $1 to $1.10 the tax is 8%; $1.10 to $1.20, 9%; $1.20 to $1.30, 10%; $1.30 to $1.40, 11%; $1.40 and over, 12%. The rate is to be based upon New York metal quotations on the day of presentation, with the added cost

at sight exchange on New York. Another clause provides that the Government reserves the right to purchase all silver bullion presented at Mexico City, at the current New York quotation, plus 1%, less all ordinary expenses of exportation, taxes, and duties. The effect of this decree, according to silver miners, will be to lessen the mining activity in Mexico, insofar as new work or the development of new properties by foreign interests is concerned. In other words it will offset the activity occasioned by the increasingly high price of silver. The fact that the new decree increased 'overnight' the taxes on silver for export will cause foreign investors to consider long before starting any new projects which have been entertained. Such large producers as San Xavier, El Tigre, and other Sonora properties, will have to pay many thousands of dollars monthly in addition to present taxes. The mineral exports from Sonora through this port during November showed a heavy decrease from October, as a result of heavy rains which prevented transportation of ore, the Yaqui Indian trouble which kept freighters off the road early in the month, and the decrease in copper production. A total of 197 carloads of ore, or 9648 tons, valued at $1,655,000, was exported. The properties were: Nacozari, 8910 tons; El Tigre, 549 tons; Estrella, 126 tons; Las Chispas, 36 tons; Monte Cristo and N. Potosi, 27 tons.

BELGIAN CONGO

A DESCRIPTION OF THE KATANGA COPPER PROPERTY.

Some interesting information regarding the operations of the Union Minière du Haut Katanga in the Belgian Congo was given out by H. Barzin, assistant-superintendent of mines for that company, during a recent trip to Salt Lake City. Mr. Barzin is a Belgian by birth, and a graduate of the University of Mons. He has been visiting the large copper and iron mines in Michigan, Minnesota, and Montana, and before returning to New York will visit the copper mines of Nevada, Arizona, and New Mexico.

The concession of the Union-Minière, the head office of which is at Brussels, Belgium, is situated about 11 degrees south of the equator, in the south-eastern part of Belgian Congo, at an average altitude of 4200 ft. The principal town is Elizabethville, on the main line of the Cape to Cairo railroad. The trip up the Congo, by water and railroad, requires about 35 days, while to Cape Town it is a 7-day trip, the distance being approximately 3000 miles. Mr. Barzin states that this railroad has a good roadbed, and that the equipment is as modern as is found in the United States, although the running-time could be improved upon. The climate is mild and healthful, and after the underbrush and tall grass is uprooted and the land drained, fevers scarcely are known. Labor is cheap and plentiful; agitators and strikes are unknown. The natives are more interested in plentiful stores of sugar, coffee, tobacco, and food than in pay. Only a passive interest in wages is displayed. The matter of a few days delay in being paid is taken with *sangfroid*, as long as meals are regular. Every few months the mining company sends out recruiting parties into the jungles to induce natives to enter a contract for a few months work at the mines or smelter. Compounds, consisting of a number of brick houses surrounded by a wall, are built for the accommodation of the natives. The single 'boys' have separate compounds from the married boys. Bathing-houses are provided and places for the washing and disinfection of clothes. At the mines the natives work 8 hours per day. Saturday is a half-holiday and Sunday is a day of rest, except for smelter workers. At the smelter 3500 natives are employed and at the various mines 12,000 natives are employed.

The concession of the company covers about 20,000 square miles. Outcrops of copper have been discovered in approximately two hundred different places in this area. In three of the mines now operating, the company's engineers estimate there are 25,000,000 tons of carbonate ores, of a high copper content. This estimate does not take into account the large deposits of sulphide ores of lower grade. In one mine an ore zone with a width of 4500 ft. averages 8% copper, and in this particuar shale formation, shoots of copper which run as high as 15% are common. So much high-grade copper is accessible for steam-shovel mining that at present no ores containing less than 15% copper are being smelted. Lower-grade ores, which must be mined in order to move the richer ores, are piled up in the reserves, to be treated by a leaching process at a later date. At present the company is producing about 4,000,000 lb. of copper monthly, with five blast-furnaces in operation. Working at full capacity, or with seven blast-furnaces running, the smelter has a capacity of 90,000,000 lb. per year. Coke is shipped in from Rhodesia.

Mr. Barzin states that the formation is more remarkable for its extent and richness of mineralization than for any unusual geological features. In all the mines the geology is similar. A quartzite formation, from 15 to 150 ft. wide, the result of alteration of the dolomite lime, is found flanked on both sides by shale. At depth the dolomite is found. The shale carries some of the best ore; mineralization in the quartzite will run as high as 13% copper and sometimes as low as 3 or 4%. The dolomite carries the sulphides, and the shale and quartzite all carbonates. In some places a talc formation, which carries good ore, is found flanking the quartzite instead of the shale. According to Mr. Barzin, little or no overburden handicaps operations, steam-shovel mining beginning practically at the grass roots. Considerable prospecting is being done. At present the company has 24 diamond-drill outfits at work. In addition to prospecting for copper, coal is being sought and considerable development work is planned within a year upon the company's tin concession, where, Mr. Barzin said, there are enormous deposits of this metal. A short time ago drilling was begun on a spot where a low-grade ore in the quartzite was found on the surface. At a depth of 40 metres, or 125 ft., a bed 120 ft. thick, averaging 33% copper, was encountered.

ARIZONA

Crown King.—A new silver discovery has been made on the property of the Silver Crown Mining Co., one-half mile east of Crown King. The ore is 6 ft. wide, 2 ft. of it assaying 110 oz., the rest being milling ore. Thomas M. Anderson is superintendent. Development is proceeding rapidly at the Mildred, adjoining the Silver Crown on the south. Machinery has been ordered for shaft-sinking purposes. The Mildred is owned by Rosenburg & Co., of Los Angeles. North of the Silver Crown is the Lincoln, the Blue Bird, and the Swastika. Two cars of ore were shipped from the Lincoln and Blue Bird last week, by the Liberty Metallic Co. A car is being loaded now from the Union by Gemmell and Saylor. Poor roads are hindering development in all parts of the district. It is necessary to pack most of the ore and supplies on burros.

CALIFORNIA

Grass Valley.—The Idaho-Maryland Co. has installed the electric hoist formerly operated at the Union Hill and is unwatering the shaft more rapidly.——The equipment formerly in commission at the El Oro group has been moved to the Central Consolidated, lately acquired by Oakland and San Francisco people. Shafts are to be sunk on the Banner and North Banner groups. John M. Nichol is superintendent.

Kennett.—Work on extensive development of the Uncle Sam mine and adjoining claims has been begun. A drift is to be driven over 4000 ft., cutting through the Alice, Snyder, Croesus, and Clipper claims. The Uncle Sam was once a famous producer of gold, but it is expected that the long drift will not only cut veins of gold ore but will go beyond into the copper-bearing territory. The work planned will take three or four years.

Masonic.—The Cook-Kibble lease on the Chemung claim of the Masonic Mines Association is shipping high-grade gold ore. A recent shipment of three tons is reported to have averaged $50,000 per ton, making it the richest ore ever sent out from this district.

Redding.—The United States Smelting, Refining & Mining Co. and the Balaklala Copper Co. have demanded the refund of taxes from the county on the ground that the raise of over $600,000 in assessment made by the Board of Equalization in July was "illegal and arbitrary". The first company asks for $7520, the second for $5391. Both claims were rejected. The copper companies announce that they will bring suits in the United States courts.——Alfred Hanford, superintendent for the Atascadero Copper Co., owning the Greenhorn mines near French Gulch, has been succeeded by W. J. Weller. Hanford has gone to Montana.

Scott Bar.—The Rockberry Mining Co. has purchased San Jose ditch and water rights and plans to extend the 14-mile ditch 8 miles into the mountains, commanding waters of Kelsey, Canyon, Middle, and Thomson creeks. Work will start next season and when completed the ditch will deliver 2500 in. of water all the year to the property. The holdings cover 500 acres extending from Scott Bar to confluence of Scott and Klamath rivers. Three giants are operating. R. J. Baker is manager.

Taylorsville. Trask & Coffer M Co plans to add 20 stamps to the 5-stamp mill next spring. Present development includes a 1000-ft. tunnel and drifts, and plans include a second tunnel, 100 ft. deeper, and a 100-ft. shaft; 4000 to 5000 tons of ore assaying 4% copper, 16 oz. silver, and $2 gold is said to be exposed. G. P. Ronan is superintendent.

Yreka.—An orebody four to five feet wide has been opened in the tunnel of the Hoboken, on Cherry creek, near Yreka. The ore shows free gold and sulphides. A 30-ton Gibson mill is in operation. The lower tunnel is expected to reach the vein shortly, and a hoist has been ordered preliminary to sinking on the vein. The property is owned and operated by R. N. Diggles of Fort Jones.

IDAHO

Coeur d'Alene.—Caledonia is producing and earning about $15,000 or $16,000 per month, which is somewhat less than its present dividend rate of $26,000 per month, according to Stanly A. Easton. The company has a considerable surplus and probably will continue the present rate until some time during the coming year, when it may be necessary to reduce it.——Rapid progress is being made in the lower cross-cut tunnel of the Sterling Silver Mountain Mining Co., on Big creek. Specimens of native silver, taken from large pieces of float encountered in driving through the slide rock in facing up the tunnel for deep operations, are being shown.

Elmore County.—A total of $90,000 will have been expended when the Treasure mine reaches a producing basis of 200 tons per day, part of which comes from Virginia interests. A deep tunnel will be driven to several veins containing gold-bearing ore, and the capacity of the mill will be increased. The mine is in the Rocky Bar district, home of the Elmora, Pittsburg, Goat, and other mines, credited with a yield of several million dollars in free-milling ore.

Hailey.—The Federal Mining & Smelting Co. is completing a tunnel that will connect its Independence and North Star mines. The bore penetrates a mountain and will permit the rapid delivery of ore from the Independence mine to the North Star mill.

MONTANA

Helena District.—It is estimated that about $350,000,000 has been taken in the past from properties in this neighborhood that are now being re-opened after lying idle for a number of years. Many of the old dumps are now being sorted and shipped to the smelters. The concentrating plant of the New York-Montana Testing & Engineering Co. at Helena is now making a test-run on several cars of ore from the Jib Mining Co. of Basin. The Liverpool mine at Clancy, 13 miles south of Helena, has been unwatered to a depth of 725 ft., leaving only 25 ft. yet to be unwatered to reach the lowest level of the mine. This mine, which has been one of the largest silver producers in this district, has lain idle for 13 years. Work of taking out the water was begun on July 18 of this year. The water was lowered to the 400-ft. level by means of an air-lift, and a station pump was erected on this level. The air-lift was again used, and the water lowered to a depth of 650 ft., at which point the

lift ceased to function owing to lack of submergence. A sinking-pump was then put down and the unwatering continued. It is expected that a large amount of profitable stoping ground will be found on the 750-ft. level when the water has been lowered sufficiently.

The recently organized Montana Mining Association has opened a well equipped office in Helena, in charge of A. M. Alderson. It is expected that this association will prove of great benefit to mine operators, prospectors, and the mining industry in general throughout the State.

NEVADA

Contact.—The Gray Copper Co. reports the development of a large deposit of 4% copper ore. Some gold and silver occurs. The property has been opened by a 1400-ft. tunnel and drifts. Continued satisfactory development will be followed by the erection of a smelter, according to E. G. Gray, president of the company. C. W. Crary is superintendent.

Ruth.—Nevada Consolidated's answer in the suit brought by Minerals Separation Co. admits that the "alleged invention is of value and utility" but denies that plaintiffs have made the invention profitable to themselves and, on the contrary, alleges that "accredited representatives and agents of Minerals Separation, Ltd. (British parent concern), did on various occasions assert that the invention could not be adapted to the ores such as defendant's ores; and further that invention was developed in the United States by others, from which alleged licenses the plaintiff gathered data and useful information adapting it to the ores of the United States". The Nevada Con. states that "for a short period prior to August 31, 1917, at McGill it installed apparatus to carry on use of ore concentration by mechanical agitation but it avers that before notice was received from plaintiffs regarding said alleged infringement it had abandoned alleged infringing use and has at no time since infringed or contemplated infringement but that on the contrary all of the uses of ore concentration which it carries on at present and has since August 31, 1917, are non-infringing uses". It denies that it has copied any of the apparatus or procedure of the plaintiff. Also that Sulman, Picard, and Ballot were not the original and first inventors of any substantial and material part of the things patented, but that they had been previously invented by several others. The answer also states that the alleged invention has been successfully applied in Australia to Broken Hill ores as early as December 1904.

WASHINGTON

Northport.—The Electric Point Mining Co., operating near Northport, has declared a dividend of $23,790. This is at the rate of 3c. per share on the issue of 793,500 shares. Payment will be made December 22. The forthcoming payment will increase the total disbursements to $301,530, all of which were made in the last three years.———Fifty tons of clean lead ore, removed in the course of sinking, has been accumulated on the dump at the No. 2 shaft of the Gladstone Mountain Mining Co. The shaft has been sunk to a depth of 56 feet.

ONTARIO

Kirkland Lake.—The official summary of operations for the Lake Shore Mines for the month of October shows that the mine was being unwatered and the shaft and manways repaired, and the storage-bins at the mill emptied and necessary repairs started. The mill-yield was $5565.80 from 345 tons.

CHIHUAHUA

Batopilas.—The Batopilas Mining Co. is expected to resume operations at an early date. J. R. Harbottle, general manager, has left Silver City for the mine.

Personal

The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

J. H. Curle is in New York.

Charles Butters has returned from New York.

C. R. Corning has returned from Paris to New York.

R. L. Richie has returned from New York and is now at Tonopah.

C. W. Purington was in Paris recently, after his return from Siberia.

K. Byron Moore sailed for Sydney from Vancouver on December 16.

F. S. Baker, of Columbia City, Indiana, has gone to Unsankino, Korea.

Walter M. Brown has left Searchlight, Nevada, for Long Beach, California.

A. H. Case, of the Development Company of America, is here from New York.

Ernest W. Miller, petroleum geologist of St. Louis, has just returned from the Orient.

A. P. Coleman, professor of geology at Toronto University, has been made dean of that institution.

J. B. Parker is flotation engineer with the Consolidated Interstate-Callahan Mining Co. at Wallace, Idaho.

T. M. Smither, recently demobilized from the First Engineers, has been investigating the Texan oilfields.

F. C. Riser, superintendent of the Chino Copper Co.'s concentrating plant at Hurley, New Mexico, is at Salt Lake City.

S. Hayashi, mechanical engineer at the Ashio copper mines in Japan, has been visiting mines and metallurgical plants in Utah.

Herbert W. Gepp, general manager for the Electrolytic Zinc Co. of Australasia, sailed from Vancouver on his return to Australia on November 29.

C. B. Lakenan, general manager for the Nevada Consolidated Copper Co., has returned to McGill, Nevada, after a trip to Chicago and New York.

T. H. Jenks of Phoenix, Arizona, and Los Angeles, is now engaged on professional work in New Mexico and Texas, and expects to visit Mexico shortly.

Denton Thompson, metallurgist of Salt Lake City, has accepted a position with the metallurgical department of the Kennecott Copper Corporation in Alaska.

E. J. Franklin, consulting mechanical engineer to the Ray Consolidated Copper Co. and Chino Copper Co., has been at Salt Lake City. He has returned to Hayden, Arizona.

Millard K. Shaler, of the Belgian Relief Commission, and engineer to the Congo company, is visiting his father at Portland, Oregon. He is returning shortly to Brussels.

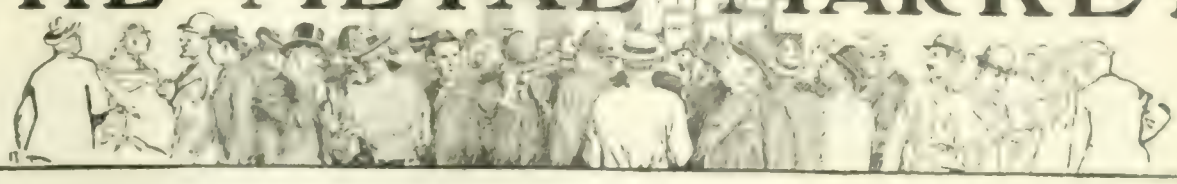
N. O. Lawton, who has been conducting exploration work at the old Pilleys Island pyrite mine on Pilleys Island, Newfoundland, for the summer, returned to New York on December 10.

W. F. Lamoreaux, manager for the Ducktown Sulphur, Copper & Iron Co. Ltd., of Ducktown, Tennessee, was here last week to attend the funeral of his brother-in-law, the late W. H. Freeland.

D. D. Moffat, consulting engineer of mills for the Jackling porphyry properties, has returned to headquarters at Salt Lake City after an inspection trip to the Chino and Ray properties in New Mexico and Arizona.

D. C. Jackling has been awarded a Distinguished Service Medal for his services during the War, when he had charge of the construction of the enormous smokeless-powder plant at Nitro, West Virginia, which involved the expenditure of nearly $70,000,000. Mr. Jackling has returned to San Francisco from New York.

THE METAL MARKET



METAL PRICES

San Francisco, December 9

Antimony, cents per pound	6.1
Antimony, cents per pound	[illegible]
Copper, electrolytic, cents per pound	18.75 - 19.50
Lead, pig, cents per pound	7.15 - 8.15
Platinum, fine per ounce	$81.50
Platinum, 10% iridium, per ounce	$81.50
Quicksilver, per flask of 75 lb.	$100
Spelter, cents per pound	10.00
Zinc dust, cents per pound	12.50 - 15.00

EASTERN METAL MARKET

(By wire from New York)

December 9.—Copper is more active and higher. Lead is quiet and higher. Zinc is stronger.

SILVER

Below are given official or ticker quotations in cents per ounce of silver 999 fine. From April 23, 1918, the United States government paid $1 per ounce for all silver purchased by it, fixing a maximum of $1.01½ on August 15, 1918, and will continue to pay $1 until the quantity specified under the Act is purchased, probably extending over several years. On May 5, 1919, all restrictions on the metal were removed, resulting in fluctuations. During the restricted period, the British government fixed the maximum price five times, the last being on March 25, 1919, on account of the low rate of sterling exchange, but removed all restrictions on May 10. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the normal rate of exchange.

	New York cents	London pence
Dec. 3	130.50	74.75
4	130.75	75.00
5	131.00	74.00
6	131.00	74.00
7 Sunday		
8	132.00	75.75
9	131.50	75.00

Average week ending	Cents	Pence
Oct. 28	119.37	64.45
Nov. 4	122.20	66.16
" 11	124.32	67.22
" 18	125.73	68.81
" 25	131.93	73.46
Dec. 2	132.00	73.50
" 9	131.29	74.75

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	75.14	88.22	101.12	July	78.92	99.62	106.36
Feb.	77.54	85.79	101.12	Aug.	85.40	100.31	111.35
Mch.	74.13	88.11	101.12	Sept.	100.73	101.12	113.92
Apr.	72.51	96.35	101.12	Oct.	87.38	101.12	119.10
May	74.61	99.50	107.23	Nov.	85.97	101.12	127.57
June	76.44	99.50	110.50	Dec.	85.97	101.12	....

COPPER

Prices of electrolytic in New York, in cents per pound.

Date	
Dec. 3	18.25
4	18.12
5	18.00
6	18.12
7 Sunday	
8	18.25
9	18.50

Average week ending	
Oct. 28	21.75
Nov. 4	21.37
" 11	21.10
" 18	21.36
" 25	19.48
Dec. 2	18.55
" 9	18.21

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	29.54	23.50	20.43	July	29.67	26.00	20.82
Feb.	34.57	23.50	17.34	Aug.	27.42	26.00	22.51
Mch.	36.00	23.50	15.05	Sept.	25.11	26.00	22.10
Apr.	33.16	23.50	15.23	Oct.	23.50	26.00	21.66
May	31.09	23.50	15.91	Nov.	23.50	26.00	20.45
June	32.57	23.50	17.53	Dec.	23.50	26.00	....

LEAD

Lead is quoted in cents per pound, New York delivery.

Date	
Dec. 3	6.75
4	6.75
5	6.75
6	6.90
7 Sunday	
8	6.90
9	6.90

Average week ending	
Oct. 28	6.66
Nov. 4	6.75
" 11	6.75
" 18	6.80
" 25	6.75
Dec. 2	6.75
" 9	6.82

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	7.64	6.85	5.60	July	10.93	8.03	5.53
Feb.	9.10	7.07	5.13	Aug.	10.75	8.05	5.78
Mch.	10.07	7.26	5.24	Sept.	9.07	8.05	6.02
Apr.	9.38	8.09	5.05	Oct.	6.97	8.05	6.40
May	10.29	6.88	5.04	Nov.	6.38	8.05	6.76
June	11.74	7.59	5.32	Dec.	6.49	6.90	....

TIN

Prices in New York, in cents per pound:

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	44.10	85.13	71.50	July	62.60	93.00	70.11
Feb.	51.47	85.00	72.44	Aug.	62.53	91.33	62.20
Mch.	54.27	85.00	72.50	Sept.	61.54	80.40	55.79
Apr.	55.63	88.53	72.50	Oct.	62.24	78.82	54.82
May	63.21	100.01	72.50	Nov.	74.18	73.67	54.17
June	61.93	91.00	71.83	Dec.	85.00	71.52	....

ZINC

Zinc is quoted in spelter, Standard Western Grade, New York delivery, in cents per pound.

Date	
Dec. 3	8.40
4	8.40
5	8.60
6	8.60
7 Sunday	
8	8.60
9	8.70

Average week ending	
Oct. 28	8.10
Nov. 4	[illegible]
" 11	7.97
" 18	8.38
" 25	8.16
Dec. 2	8.31
" 9	8.48

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	9.75	7.78	7.44	July	8.98	[illegible]	[illegible]
Feb.	10.45	7.97	6.71	Aug.	8.58	8.78	7.81
Mch.	10.78	7.67	6.58	Sept.	8.44	9.08	7.57
Apr.	10.20	7.04	6.49	Oct.	8.32	9.11	7.89
May	9.41	7.92	6.43	Nov.	7.76	8.75	8....
June	9.03	7.92	6.91	Dec.	7.84	8.49	

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. Prices, in dollars per flask of 75 pounds:

Date	
Nov. 10	80.00
18	80.00
Nov. [illegible]	75.00
Dec. "	95.00
" 9	100.00

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	81.00	128.06	103.75	July	102.00	120.00	100.00
Feb.	126.25	118.00	90.00	Aug.	115.00	120.00	103.00
Mch.	113.75	112.00	72.80	Sept.	112.00	120.00	102.60
Apr.	114.50	115.00	73.12	Oct.	102.00	120.00	86.00
May	104.00	110.00	84.80	Nov.	102.50	120.00	78.00
June	85.00	112.00	94.40	Dec.	117.42	115.00	

MONEY AND EXCHANGE

Carter Glass, Secretary of the Treasury, in his annual report to Congress on the international financial situation, says in part:

"The Treasury believes the need of Europe for financial assistance very great and real, although it has been much exaggerated here and abroad. There is no reason for high commodity prices in the specter of Europe in demand nor for high interest rates in the specter of European needs. Our fear must be that cessation of war exports will result in vessel glands, passed dividends and general depression. The way to avoid these evils is to stimulate production and encourage industries and commerce actively and not to burden them with high interest rates.

"There are those who believe the dollar should be kept at par—no more—no less—in the market of foreign exchange. If effective action were taken to carry out such a policy it could be done only by drawing gold out of the United States when the dollar would otherwise be at a discount and by adding credit when the dollar would otherwise be at a premium. The dollar is now at a premium almost everywhere in the world. Its artificial reduction and maintenance at gold par of exchange in all currencies is quite unthinkable, unless we propose to level all differences in relative credit of nations and for our good reserve substitute a reserve constituting promises to pay of any nation that chooses to become our debtor. Inequalities of exchange reflect not only the trade and financial balance between two countries but particularly, after a great war, the inequalities of domestic finance. The United States has met a greater portion of cost of the War from taxes and bond issues than any other country. For the United States to determine by governmental action to depress the dollar as measured in foreign exchange and improve position of other currencies as measured in terms of dollars would be to shift to the American people the tax and loan burdens of foreign countries.

"It is not to be expected that the breach left by withdrawal of governmental support of exchange can be filled by private initiative until ratification of the treaty of peace has given reasonable assurance against the political risk which, rather than any commercial or credit risk, now deters private lenders. The Treasury favors the making, in our markets, of such loans, which contribute to relieve the exchanges. I am sure that when peace is consummated, and the political risk measurably removed, American exporters and European importers will lay the basis of credit in sound business transactions, and I know that American bankers will not fail then to devise means of financing the needs of the situation nor American investors to respond to Europe's demand for capital on a sound investment basis.

"Meanwhile it is well to remember the invisible factors, which are always at work toward solution of the problem. Immigrants' remittances to Europe will continue to be a large item in rectifying exchanges. As soon as peace is concluded foreign travel will be a further item. Another important factor is the purchase of European securities and properties and the re-purchase of foreign-held American securities by American investors. But the principal factor in Europe's favor is the inevitable curtailment of her imports and expansion of her exports. These processes, of course, are stimulated by the very position of the exchanges they tend to correct."

Quotations on December 9 are as follows:

Sterling:	Cable	3.85¼
	Demand	3.85
Francs:	Cable	
	Demand	11.36
Lire:	Demand	12.90
Marks		2.29

Eastern Metal Market

New York, December 3.

All the markets are quiet but show differences of trend; some are strong to steady and others weak.

Copper has continued to decline and the whole market is weak. This situation has also been reflected in stock-market quotations.

Heavy sales of tin have been made in a strong, quiet market.

Demand for lead is light, but prices are firm and the tone is steady.

Zinc prices are higher both here and in London and the market is quiet but strong.

Antimony is unchanged.

IRON AND STEEL

Unless the coal output can be considerably increased the steel industry will soon face serious curtailment, the shortage already shutting off production in some districts. The place of steel in the essential list will be much farther down in the scale than in the war-time heatless days of 1918. Four blast-furnaces have had to be banked by the Bethlehem Steel Co., and the Illinois Steel Co. at South Chicago has had to bank five blast-furnaces and blow out one. Most of the bar-iron and re-rolling mills in the Chicago district are idle and two iron mills at Cleveland. Pig-iron output in November made a distinct recovery from the strike conditions in October. The November total was 2,392,350 tons, or 79,745 tons per day against 1,863,558 tons in October, or 60,115 tons per day. December will probably show a considerable lapse. Furnaces in blast December 1 were 251 with a capacity of 84,550 tons per day, against only 231 on November 1, producing 65,625 tons per day. Because of the coal situation steel companies have brought their sales forces to a standstill, but demand is coming in from all directions so that business is piling up. Some companies are reaping the benefit of premium prices. Export business can have little consideration under these conditions.

COPPER

The more important producing interests continue to lower their quotations, but consumers still exhibit a decided reluctance to enter the market. Production also is considerably larger than consumption. As a result prices have again fallen. Electrolytic copper for December delivery is obtainable as low as 18.25c., New York, which we quote as the market. It could perhaps be obtained as low as 18c. in certain quarters. Lake copper is largely nominal at 18.75 to 19c., New York, for December delivery. Were it not for the value of silver many of the smaller producers could not sell copper at a profit under 21c. In general, consumption is figured as only about 50% of actual supplies, or 60,000,000 lb. per month, with production and imports totaling 120,000,000 to 130,000,000 lb. Today a better demand has started to appear with certain consumers at least inquiring for substantial quantities. It is not known at this writing whether this has resulted in much business or not.

TIN

With the exception of one day, about the middle of last week, the market has been quiet and steady. On the day referred to large sales were made for November, December, January, and February shipment from the East at prices ranging from 54.12½ to 54.50c. It is estimated that these sales aggregated at least 1000 tons. On all other days there have generally been more sellers than buyers. Spot Straits tin has sold in limited quantities at prices ranging from 54 to 54.37½c., New York, the last quotation yesterday having been 54c. On the whole, deliveries of the metal are very good, although congestion still prevails at the docks. Because of this, deliveries into consumption in November were not as large as many had expected. The total was 6665 tons, whereas not less than 7000 tons was looked for. Of this total 5600 tons is credited to Atlantic ports. The quantity in stocks and landing as at November 30 was 4955 tons, still a relatively large amount. Consumption of tin in general is better. The London market has risen rapidly—too fast to be followed by this market.

LEAD

The market has been quiet and steady but very little business has been done. Most producers have little to sell, but they seem more disposed to meet the market than they did a week ago. Some are holding at a premium above the A. S. & R. Co.'s price of 6.75c., New York. Spot lead as re-sale material has been available at 6.75c., New York, in small quantities. We quote the market firm at 6.75c., New York, and 6.55c., St. Louis, the latter being still at a slight premium over the 6.50c. quotation of the leading interest.

ZINC

Prime Western for December delivery has again gradually advanced and is today quoted at 8.10c., St. Louis, or 8.45c., New York. This is 20 points over the level a week ago. The London market is also higher. Prospects for foreign consumption are good and domestic demand is fair. Many producers are fairly well booked on orders taken in November and are disposed to wait, but others are willing to take advantage of present levels and sell. The tone of the entire market is strong and prospects fairly good.

ANTIMONY

Wholesale lots for early delivery are quoted at 9.25c., New York, duty paid, with the market quiet and steady.

ALUMINUM

Virgin metal, 98 to 99% pure, is obtainable at 32 to 33c. per pound, New York, in wholesale lots for early delivery. Re-melt metal of the same analysis is 1c. per pound less.

ORES

Tungsten: There is little change in the general situation. Quotations are nominal at $7 to $12 per unit in regular concentrate, depending on the quality of the ore. It is argued by some that now is the time to buy for future consumption, as prices will more likely advance than otherwise within the next year, so that those who stock up now are likely to be in pocket at the end of a year. Ferro-tungsten is nominal at $1 to $1.25 per pound of contained tungsten. British ferro-tungsten has already been shipped to this country.

Molybdenum: The market is quiet with quotations nominal at 75c. per pound of MoS_2 in 90% concentrates.

Manganese-Iron Alloys: Sales of 1500 to 2000 tons of American ferro-manganese have been made at the new price of $120, delivered. One British maker is again in the market for first quarter delivery at $110, seaboard, and sales have been made on these terms. Spiegeleisen is active and strong at $37 to $45, furnace, with domestic orders good. About 4000 tons is under negotiation for foreign consumption, of which 2000 tons is for direct shipment to Germany.

Ferro-chromium: Prices are lower and the market is active. The regular alloy, 60 to 70%, is quoted at 22 to 23c. per pound of contained chromium, with the carbon range at 6 to 8% in carload lots; in less than this 1c. per pound more is asked. For 4 to 6% carbon alloy the asking price is 1c. per pound higher than the foregoing levels.

Book Reviews

Applied Science for Metal Workers. By William H Dooley. Pp. 467, ill., index. The Ronald Press Co., New York. For sale by 'Mining and Scientific Press'. Price, $2.

This book is designed particularly for use as a textbook in the metal working classes of vocational high-school courses. The principal facts of elementary physics and chemistry are discussed and their application to the metal-working trades considered. The treatment is necessarily condensed, but the explanations are clear, and the book could be read and even studied with profit by many that are not high-school students.

Quantitative Analysis by Electrolysis. By Alexander Classen. Revised and enlarged translation by Wm. T. Hall. Pp. 346, ill., index. John Wiley & Sons, Inc., New York. For sale by 'Mining and Scientific Press'. Price, $3.

The original edition of this book, which appeared in 1882, has been subject to frequent revision and the present volume is practically a new work. In addition to a comprehensive discussion of fundamental theories and recent developments tending to establish electro-analysis on a more scientific foundation, methods and procedure in various determinations are detailed. Part 4 gives directions for about 20 analyses which are of special practical value. The book should be of use to chemists whose work includes problems in electrolytic analysis.

Strength of Materials. By John Paul Kottcamp. Pp. 189, ill., index. John Wiley & Sons, Inc., New York. For sale by Mining and Scientific Press'. Price, $1.50.

This is an elementary textbook requiring a knowledge of algebra and preferably of theoretical mechanics on the part of the student. The first chapter reviews the elementary principles of the latter subject, after which simple stresses are discussed. The more common materials of construction, their strength and the methods used in their manufacture are then considered. Stresses in, and the design of, beams, shafting, columns, and riveted joints are then discussed in their order. The last two chapters deal with combined stresses and resilience, and with reinforced concrete. A number of practical problems are given at the end of each chapter.

Handbook for Highway Engineers. By Wilson G. Harger and Edmund A. Bonney. Third edition. Pp. 969, ill., index. McGraw-Hill Book Co., Inc., New York. For sale by 'Mining and Scientific Press'. Price, $5.

In the third edition of this useful handbook about 350 pages of new material has been added, covering particularly mountain-road location and design, camp equipment, camp hygiene and medicine, photography, special design of roadbed for moderate-traffic roads, and the more recent developments of hard-surfaced types. The general arrangement of the book is unchanged from previous editions. It is a handbook rather than a textbook, and as such will be found useful by the engineer that has to do with either highway construction or maintenance.

Foundry Practice. By R. H. Palmer. Second edition. Pp. 377, ill., index. John Wiley & Sons, Inc., New York. For sale by 'Mining and Scientific Press'. Price, $3.

In preparing the second edition, the book has been revised and some new material added, principally about methods of making particular types of castings. The first part of the book deals with molding, commencing with the simpler kinds of castings and proceeding to the discussion of the more complex. There are special chapters on gates, risers, and feeding-heads. Cleaning and mending castings are also discussed. A chapter is devoted to molding-machines. Other chapters discuss iron and its composition, the cupola, the air-furnace, the brass foundry, and foundry equipment. There is a glossary and an appendix containing mathematical and other tables. The book will be useful not only to the student and the apprentice, but also to the experienced molder.

Principles of Reinforced Concrete Construction. Third Edition. By F. E. Turneaure and E. R. Maurer. Pp. 481, ill., index. John Wiley & Sons, Inc. For sale by 'Mining and Scientific Press'. Price, $3.75.

The third edition of this standard treatise has been rearranged and considerable new material added. In particular a new chapter has been written covering the analysis of flat slabs and the chapter on building construction has been extended to include a more detailed treatment of continuous beams and girders. The chapter-headings, besides the introduction, are Properties of the Materials; Theory of Flexure of Beams; Shear and Bond Stress; Design of Beams; Deflection of Beams; Columns; Analysis of Flat Slabs; Building Construction; Arches; Retaining-Walls and Dams; Miscellaneous Structures; Reinforced Concrete Chimneys; Diagrams and Tables. An appendix contains the report of the joint committee of the various engineering societies and other interested organizations on 'Design and Working Stresses'. The book is intended as a text rather than for reference, but its use for the latter purpose would be materially facilitated by a more complete index. It will, however, be of great value to those engaged in reinforced concrete construction.

Engineering Education. Essays for English, selected and edited by Ray Palmer Baker. Pp. 185. John Wiley & Sons, New York. For sale by 'Mining and Scientific Press'. Price, $1.25.

This attractive little book contains 14 articles, all written during the last twenty years, by authoritative exponents of literary English as applied to the expression of scientific ideas. This series of articles is meant "to present an ideal of engineering education" such as cannot be found elsewhere. Each of the seven divisions of the general subject is discussed by two distinguished men: 'The Origins of Engineering Education', by Simon Newcomb and J. J. Thomson; 'The Types of Engineering Education', by John Butler Johnson and Howard McClenahan; 'The Bases of Engineering Education', by John Lyle Harrington and Charles P. Steinmetz; 'Mathematics', by Sir William White and Arthur Ranum; 'Physics', by Matthew A. Hunter and Robert A. Millikan; 'Chemistry', by John B. C. Kershaw and Alfred Senier; 'Imagination', by Isham Randolph and Julian C. Smallwood. It will be noted that several Englishmen take part in the symposium. The book is not only a discussion of a timely and engrossing subject, but it furnishes an excellent example of style to those desirous of improving their use of the language. It is a book for thoughtful men and women.

Public Utility Rate Fixing. By C. E. Grunsky. Pp. 164, ill., index. The Technical Publishing Co., San Francisco. For sale by 'Mining and Scientific Press'. Price, $2.50.

Questions of rate-fixing and valuation are engaging and will continue to engage the attention of many engineers. Since the question is partly an engineering and partly a legal one, there is less agreement among the authorities than if it were entirely a matter of engineering. The author of the present volume has already contributed to the literature on the subject in 'Valuation, Depreciation, and the Rate Base', and in a paper on appraisals presented before the American Society of Civil Engineers in 1912. In the latter

paper he was among the first to controvert the hitherto accepted theory that accrued depreciation should be considered in fixing rates, even though the property of the utility be maintained to give 100% service. Also in this and other writings he advocates, in the fixing of rates, the determination of a 'natural rate-base' as distinguished from fair value. The first chapter is devoted to a general discussion of rate-fixing. The second treats of special factors to be considered in determining rates, such as obsolescence, losses from fortuitous events, hazard, reward for management, unearned increment, volume of business, and going value. The point that will be found of the greatest interest by most readers is the contention that the volume of business rather than the amount invested should be the principal factor in determining reasonable profit over and above interest on investment. Valuation of real estate is then considered, and then depreciation and appreciation, the inadequacy of many of the most popular formulas being pointed out. Succeeding chapters discuss the value of a water-right, the rate of return, the rate-schedule, the public utility rate-base, and fair value and the rate-base. Many examples are given from court decisions, particularly the Spring Valley Water Co. case in San Francisco. While some valuation engineers wil not agree with many of the conclusions expressed, they will all find the book to be of interest and value.

Engineering Descriptive Geometry and Drawing. By Frank W. Bartlett and Theodore W. Johnson. Pp. 577, ill., index. John Wiley & Sons, Inc., New York. For sale by 'Mining and Scientific Press'. Price, $5.50.

The senior author is a captain in the U. S. Navy and was formerly a professor at the Annapolis Naval Academy; the junior author is now a professor at the Academy. The book is primarily a textbook for use at the Academy; in fact, it would be difficult to use it as a textbook at any other technical school unless the courses of instruction had been modeled directly on those at Annapolis. The treatment of the various subjects has the thoroughness that we are accustomed to associate with military and naval matters. The book is divided into three parts, which are virtually independent of each other. Part I on Line-Drawing discusses thoroughly the various instruments and other equipment required in the drafting-room, together with their use. The remainder of this division of the book is devoted to ordinary lettering and line-drawing, as these subjects are taught at Annapolis. Part II, on Engineering Descriptive Geometry, discusses in an equally thorough manner the descriptive geometry of lines and plane and curved surfaces, together with isometric sketching. Part III on Engineering Drawing proceeds from the discussion of simple sketches of small machine parts to the more difficult branches of mechanical drawing, including ship lines and plate and structural-steel work. There is an appendix giving lists of standard pipe-fittings, bolts, screws, and structural material.

The Strategy of Minerals. Edited by George Otis Smith, Director of U. S. Geological Survey. Pp. 360, maps and tables. D. Appleton & Co., New York. For sale by 'Mining and Scientific Press'. Price, $2.

This book gives emphatic point to the proposition of our national dependence upon mineral resources. This is one more of the lessons brought home to us by the War, and the thirteen chapters, by as many government officials, point out, first, the unusual requirements brought about by the War, second, the way in which these requirements were met, and third, the necessity for maintaining efficient production, with a constant recognition of the need for conservation, now that the War is over. The vital importance of mineral supply is illustrated by Germany's ability to continue the War as long as she did, solely by virtue of her possession of the minette iron deposits. There are brief surveys of our resources in fuels, iron, copper, lead, zinc, and miscellaneous minor minerals, with some general information of a statistical character. That we are far more abundantly endowed with mineral wealth than any other country is demonstrated, and in the final chapter the editor points out the need for exceptional foresight and sagacity in organizing industry in this country. He has faith in "the scientific efficiency of the American engineer, the highly productive capacity of American labor, and the far seeing conservatism of American democracy". The book commends itself to readers of forward vision.

Recent Publications

Graphite in 1918. By Henry G. Ferguson. II:10, U. S. Geological Survey, 1919. Pp. 43, map. From Mineral Resources of the United States, 1918—Part II.

Antimony in 1918. By Henry G. Ferguson. I:4, U. S. Geological Survey, 1919. Pp. 25, map, diagram. From Mineral Resources of the United States, 1919—Part I.

Antimony in 1918. By Henry G. Ferguson. I:4, U. S. Geological Survey, 1919. Pp. 25, map, diagram. From Mineral Resources of the United States, 1918—Part I.

Magnesite in 1918. By Charles G. Yale and Ralph W. Stone. II:7, U. S. Geological Survey, 1919. Pp. 18. From Mineral Resources of the United States, 1918—Part II.

Deposits of Manganese Ore in New Mexico. By Edward L. Jones, Jr. Bull. 710-B, U. S. Geological Survey, 1919. Pp. 24. From Contributions to Economic Geology, 1919—Part I.

An Eocene Flora from Trans-Pecos, Texas. By Edward Wilber Berry. Professional Paper 125-A, U. S. Geological Survey, 1919. Pp. 9, ill. Shorter Contributions to General Geology, 1919.

Coke and By-Products in 1916 and 1917. By C. E. Lesher and W. T. Thom, Jr. II:34, U. S. Geological Survey, 1919. Pp. 66, table. From Mineral Resources of the United States, 1917—Part II.

Quicksilver in 1918. By F. L. Ransome. With a Supplementary Bibliography, by Isabel P. Evans. I:7, U. S. Geological Survey, 1919. Pp. 40. From Mineral Resources of the United States, 1918—Part I.

Silver, Copper, Lead, and Zinc in the Central States in 1918. Mines Report. By J. P. Dunlop and B. S. Butler. I:5, U. S. Geological Survey, 1919. Pp. 67. From Mineral Resources of the United States, 1918—Part I.

Gold, Silver, Copper, and Lead in South Dakota and Wyoming in 1918. Mines Report. By Charles W. Henderson. I:8, U. S. Geological Survey, 1919. Pp. 10. From Mineral Resources of the United States, 1918—Part I.

Surface Water Supply of the United States, 1917. Part VII. Lower Mississippi River Basin. Nathan C. Grover, Chief Hydraulic Engineer, Robert Follansbee, District Engineer. Water-Supply Paper 457, U. S. Geological Survey, 1919. Pp. 33, ill., index. Price, 10 cents.

On a New Exogyra from the Del Rio Clay and Some Observations on the Evolution of Exogyra in the Texas Cretaceous. By Emil Böse. University of Texas Bull. 1902, 1919. Pp. 22, ill. Bureau of Economic Geology and Technology, Division of Economic Geology. Published by The University of Texas, Austin, Texas.

Geology and Ground Waters of the Western Part of San Diego County, California. By Arthur J. Ellis and Charles H. Lee. Prepared in co-operation with the Department of Engineering of the State of California and the City of San Diego. Water-Supply Paper 446, U. S. Geological Survey, 1919. Pp. 321, maps, diagrams, tables. Price, $1.

INDUSTRIAL PROGRESS

INFORMATION FURNISHED BY MANUFACTURERS

A MOTOR-TRUCK IMPROVEMENT

Problems having to do with the use of the motor-truck in soft going, such as muddy roads in pioneer mining districts, have apparently been solved by the Fulton Motor Truck Co., Farmingdale, Long Island. This company has just announced the Fulton 'ground grippers', designed to promote the wider use of the motor-truck where the ground is muddy and impassable for trucks equipped with ordinary tires. This invention requires but little time for application to the wheels, which need not be removed when the truck passes from soft to hard ground. The 'grippers' are so placed upon the wheels that they do not come in contact with hard ground and do not injure the roads. They grip as soon as the wheels bear down into soft material.

'Ground grippers' are wide iron bands with metal flanges bolted diagonally across the outside of the band. These flanges are similar to those found on tractor wheels. They are attached to the wheel of the truck in a simple way requiring only 20 minutes to place all four bands in position for work. There are four 12-in. bolts with special wide metal bands. These bolts are attached to two L-shaped metal strips, which are held in position by two spokes. The bolt from these strips is attached by nut and washer to the band and quickly tightened.

A Close View of the Fulton 'Ground Gripper'

Fulton 'Ground Grippers' Enabling a Fulton Truck Loaded to Full Capacity to Traverse Heavy Ground

Thorough tests have been made with the 'ground grippers' for some time. Their advantages for outlying mining districts are evidenced by the fact on freshly ploughed fields, one of the most troublesome types of ground a motor-truck is likely to attempt, the 'grippers' have enabled the transportation of heavy loads and have given the utmost satisfaction. Passing from the field to the road the 'grippers' are left in position, as the flanges are so placed that they clear the road-bed and cause no injury to it. If soft ground is encountered on the road the flanges immediately take hold. The accompanying illustrations show the type of ground on which motor-trucks equipped with these 'grippers' are being successfully run.

The building of the electrically-operated battleship 'California', which was recently launched at the Mare Island Navy Yard, was facilitated by the use of two ship-building cranes of the hammer-head type,

built by the **McMyler-Interstate Co.** of Cleveland, Ohio. The San Francisco offices of this company are in charge of L. A. Somers, who will be glad, on written request, to furnish bulletins describing these cranes and other types of cranes this company manufactures. Requests should be addressed to the company's offices, 407-409 Merchants Exchange Bdg., San Francisco.

COMMERCIAL PARAGRAPHS

'Telsmith Jaw Crushers' is the title of bulletin 264, issued by the **Smith Engineering Works**, Milwaukee. This bulletin describes jaw-crushers from 7 by 12 in. to 11 by 20 in., together with elevators, portable bins, and other accessory equipment.

Grubnau, Bryant & Grubnau are operating a zinc-oxide plant at Waldo, New Mexico, manufacturing zinc oxide and zinc-lead pigments for sale to the rubber industry and paint industry. They are making the finished product, put up in 10-lb. paper bags and 300-lb. barrels, according to the requirements of their customers.

The Goulds Mfg. Co., Seneca Falls, N. Y., have issued bulletin No. 122, entitled 'Centrifugal Pump Sales Service Data'. This was originally issued as a series of sales letters for use in their own organization, but the demands from outside have been so great that it has been decided to print it in their regular bulletin form. This bulletin contains a large amount of information on theory, design, testing, and many other matters connected with centrifugal pumps that have never been published before, and should be extremely useful to anyone who has occasion to purchase or operate centrifugal pumps. The company will be glad to send copies on request.

Recently there was organized in Chicago a new corporation under the laws of the State of Illinois to be known as **The Booth Electric Furnace Co.**, with paid-up capital of $1,000,000. Of this amount one-half is preferred stock and one-half common. The new company has acquired all the patents, assets, and good-will of the Booth-Hall Co., manufacturers of electric steel and brass-melting furnaces, and has taken over the business formerly carried on by that company. It will greatly enlarge the scope of operations, and develop the electric furnace business along standard manufacturing lines rather than on a special engineering contracting basis.

The Sierra Asbestos Co., whose mines and mill are in Nevada county, California, have made a great success in reducing the serpentine rock containing the veins of chrysotile asbestos by crushing with a 20-stamp mill and Canadian fiberizer, separating the fibres by screening and air suction. The stamp-mill puts through 100 tons of ore per day, which is to be soon increased to 200 tons per day. Trucks are now hauling the asbestos fibres of No. 1, 2, 3, and 4 grades for shipment. John D. Hoff and R. E. Conrad calculated the mining and milling possibilities of this asbestos mine. Large quantities of asbestos fibre are used for asbestos plastic flooring and asbestos stucco on the Coast.

The Allis-Chalmers Mfg. Co. has received an interesting letter from H. A. Martens, vice-president of the Mayville White Lime Works, testifying to the durability of a crusher bought from them in 1882. Mr. Martens says in part: "The old No. 5-B crusher, sold by you in 1882, is still 'on the job'. We started operation in our Richwood quarry in the month of May and we have had no repair work except re-babbitting, up to this time. It seems that the old crusher has been active in a good many quarries since 1882, but according to all appearances it has stood the knocks and hard service very satisfactorily. Judging from the condition at the present time it ought to be crushing stone for a good many years yet."

Bulletin No. 400 on the DFC oil-forge, and bulletin No. 450 on DFC melting-furnaces, are two pamphlets issued by the **Denver Fire Clay Co.** The first treats of an oil-forge designed for heating drill-steel, and describes in detail the burners, motor-blower, and pyrometer that are part of the equipment of the forge. The second bulletin describes the various fuels that may be used for melting-furnaces, the types of burners, tanks, and other equipment best adapted to these different fuels, and then takes up the furnaces for use with each fuel. Both bulletins are amply illustrated, and contain list-prices. They have been arranged with the idea of presenting the material in such a form that it will be of interest to all users of furnaces and forges. Copies will gladly be furnished on request to the company.

Modern industrial enterprises have expanded to such a degree that the handling of material in quantity for comparatively short distances is no longer practicable by the old wheelbarrow method. Without reference to the high cost of such outworn methods, the present labor shortage makes them almost impossible where materials must be handled on a large scale. Various automatic devices, of which the belt-conveyor, and particularly the portable belt-conveyor, is one of the chief exponents, have been coming into increasing use every year. Therefore the appearance of a carefully compiled catalogue on belt-conveyors and bucket-loaders, such as that just issued by the **Barber-Greene Co.**, Aurora, Illinois, is always welcomed by those whose work involves the handling of large quantities of ore, coal, coke, ashes, and many other substances. This catalogue, which is known as No. 3, is a 32-page, 8½ by 11-in. booklet. It is profusely illustrated with exceptionally clear half-tones showing various types of conveyors and elevators at work under many different conditions, and accompanied by descriptive matter and tables. Emphasis is placed upon the advantages of the portable conveyor, particularly for storing bituminous coal, where there is always danger of a fire putting stationary equipment out of commission. This catalogue should be in the hands of every user or potential user of conveying machinery.

'Dependable Power' is the title of a catalogue issued by the **Midwest Engine Co.**, Indianapolis, through its exclusive representatives, Collins & Webb, of Los Angeles and San Francisco. This catalogue describes attractively and clearly the organization, plant, and products of the Midwest Engine Co. For nearly 50 years this organization has concentrated its energies on the design and manufacture of engines. The results of this continuous effort in one field can be seen when it is stated that during the War this company sold to the United States and its Allies over 600,000 hp. of heavy-duty oil-engines, Diesel type, besides large quantities of steam-turbines, gasoline motors for artillery tractors, gasoline engines for submarine chasers, turbine-driven lighting and pumping sets, and other smaller units. The heavy-duty oil-engines are made in units from 75 hp. to 666 hp. each. With this company's broad experience as a specialist in the manufacture of engines, it is rare for any engineering problem to arise in which some member of its engineering service department has not had exhaustive personal experience. The value of this experience to its present as well as prospective clientiele cannot be overestimated. It is a part of Midwest service to make, on request, an exhaustive survey of the conditions under which any prospective piece of equipment will have to operate, and to render scientific and expert judgment on the precise type of equipment that, under the determined conditions, will give maximum service at minimum first cost and minimum maintenance expense. If a client maintains an engineering department of his own, Midwest engineers are at his disposal to check his conclusions and assist in any manner found desirable.

AS it is so near the end of the year, we shall postpone the serial publication of Mr. Sulman's paper on flotation, in order to avoid part of it appearing in one volume and the remainder in a later volume of our own journal. The series will begin to appear in January.

CROP statistics are most favorable. Thanks largely to the increased area put under cultivation, the value of farm crops for 1919 is estimated at 14 billion dollars, which is 1½ billions better than last year. There is need for all this supply of food, at home and abroad. We congratulate our friends the farmers, and invite them to put some of their excess profits into mining.

MOLYBDENUM is a metal that has come to the front during the War, as a factor in the manufacture of alloy-steels. We are glad to publish a thoughtful and suggestive article on this metal and its industrial uses, by Mr. W. E. Simpson, of Cobalt, Ontario. It is worthy of remark that the American Metal Company, through a subsidiary company, appears to have started a campaign of advertisement in behalf of this kind of steel, most of its full-page displays carrying the slogan, "Out of the furnace of war came molybdenum steels." The company mentioned owns, as our readers are aware, a molybdenum mine called the Climax, near Leadville, which was described in an article by Mr. L. F. S. Holland appearing in our issue of October 19, 1918.

COAL MINING in the bituminous fields has been resumed generally and the strike is declared 'off'. The President sent a 'may I not' to the leader of the strikers and he responded by promising his "sincere cooperation", but we do not like the nature of the settlement, which is temporary and fraught with further trouble. The Government, through the Fuel Administrator, decided, after careful enquiry, that conditions justified a raise of 14% in the coal workers' wages, but did not warrant any increase in the price of coal to the consumer. Mr. Garfield estimated that the 14% would [illegible] the advance in the cost of living since the last adjustment of wages. Later the President started negotiations, through his secretary and the Attorney-General, with the leaders of the striking unions and arranged for the grant of the 14% raise, together with an agreement to submit the controversy to a commission of three, which, among other things, will decide whether an increase in the price of coal is justifiable. Thus the judgment of Mr. Garfield was set aside and he was placed in a position compelling him to tender his resignation as Fuel Administrator. He will take with him the respect and gratitude of the public. It seems to us that he showed sagacity and fairness in his treatment of the big problem with which he was suddenly confronted and if he had been properly supported he could have settled it satisfactorily and definitely. Now it remains unsettled, and, what is worse, the use of threat and clamor by the unions has been permitted to prevail.

AMONG the publications announced by the University of California Press is one on the geology of the Santa Ynez district. We hope and believe that this publication is valuable, but it is evident from quotations appearing in the current press bulletin from the University that the report needs editing. For instance, we read that "although the stratigraphy of the Santa Ynez district is similar to that usually occurring throughout the California Coast ranges, a few observations of interest may be emphasized." How can a stratigraphy "occur" usually or unusually anywhere? why should the adjective of the word 'California' be ignored? and why should it be necessary to emphasize anything that the gentleman is able to render interesting; or if he emphasizes it, does it not become interesting forthwith? Indeed, why should geologists be false to their education?

ON another page we publish a letter, by an engineer unwilling to disclose his name, taking up the cudgels in defence of the War Minerals Relief Commission, and protesting against the attempts of unsuccessful producers of War minerals to make the Government pay the costs of their ventures. Our correspondent characterizes the affair as "dollar patriotism", and states, in substance, that the mines were developed and equipped as ordinary business enterprises, undertaken for profit, and that patriotism played a subordinate rôle in determining the actions of their promoters. This letter is interesting as setting forth a side of the question with which we are not at all in sympathy; so we shall demur to some of our correspondent's statements. As has been previously acknowledged, the expectation of a legitimate profit undoubtedly was a factor in motivating many of the producers; so long as men have families to support they must consider that obligation; all are not so fortunately situated as to be able to place their services and their funds gratuitously at the disposal of the Government. But

the fact that patriotism was not the only motive behind many of these enterprises seems to us beside the question. There is a clear distinction between the business enterprise undertaken solely for profit, in which the risks are carefully balanced against the expectant gain before setting to work, and the enterprise undertaken in response to the urgent appeal of the Government, when, for the avowed purpose of stimulating production, it extends certain guarantees intended to protect the promoters against risks that ordinarily would cause them to prefer some other business. For instance, one example cited by our correspondent details the experience of some miners of chrome ore, who, in November 1918, were "assured that the 1918 schedule would be continued until July 1919". That is the crux of the matter. Prospective miners of war minerals, considering the advisability of equipping properties for an uncertain life, were at the first glance obliged to face the probability of an early end to the War and a consequent disastrous break in metal prices. The prospect was not attractive. But at this stage the Government, through a well-organized publicity campaign, in the course of which it used the 'Mining and Scientific Press', advertised that the metals were urgently required and that it would protect producers to the extent of guaranteeing the market until July 1919, as our correspondent states. This assurance satisfied the operators; confident that they were protected from the loss of their market, they erected their plants and commenced production. The issue now is not how much self-interest was alloyed with their patriotism, nor how some irresponsible operators defrauded their creditors, nor how an occasional venture was profitable in spite of the collapse of the metal-market. The issue is, shall the Government redeem its pledge to the miners?

FROM Washington comes the grandiose statement that the money owed by foreign governments to the United States is equivalent to $100 for each man, woman, and child in our country. This is misplaced emphasis. With the pound sterling at $3.60 and the mark worth two cents, it is possible that neither the $100 nor the interest on the $100 will be forthcoming. When a merchant's customers are threatened with insolvency, he does not congratulate himself. That $100 owing to each one of our own people depends for its value upon the restoration of international commerce, which is hindered by the continuation of a state of war between us and the German alliance. The drop in quotations on the New York Stock Exchange is closely related to the collapse of European exchange. The idea that the United States is an island in mid-ocean is as economically unsound as it is geographically untrue.

ANOTHER strike is over, thank Heaven. We congratulate our contemporary in New York, and the other publishers victimized by the pressmen's union, in having brought the affair to a satisfactory conclusion. It would have ended sooner if the compositors had not chosen to go on vacation. This pressmen's strike and its sequelae are to be deplored by all those who wish labor to be justly treated, because in this case sundry unions showed themselves to be undisciplined and dishonorable. The pressmen broke the agreement of their own national organization and the compositors took concerted action to stop work without even going through the form of stating their grievance. Such performances can do no good to the cause of organized labor. Bad faith will damn any cause. If unionism is to prevail as a means for peaceable adjustment of industrial disputes, it must 'play the game'.

HUMOR is no more lacking in mining than in other human affairs. We have been privileged recently to read a report, meant to be serious, on a mine in Eldorado county, California. The writer of the report starts by stating his intention "to ascertain facts, not fancies, conditions, not theories, avoiding always the sinking shafts of the imagination into chimerical bonanzas of hope". That augurs well; but he ends by doing exactly what he set out not to do, and soon has to acknowledge that he may be charged with indulgence "in optimistic dreams or driving Utopian drifts into exhaustless pay-shoots of wealth, deep-seated but opaque". This characterization of flapdoodle is not as good as the one with which he started. Unabashed, however, he proceeds to dwell upon "the romantic, marvelous tale" of Eldorado county, where gold was first discovered in California, and to expatiate upon the early days "when every stream, every flat, every bench, and every hillside [why not say "the entire landscape"?] was literally [and apparently 'illiterately'] strewn with gold, released by ages of erosion from the gold-quartz veins and from the break-outs [what a breaking out of verbiage is here!] in the ancient channels of gravel which occupied the ridges". Then comes a description of pioneer mining, followed by a reference to the Mother Lode, thus: "The gathering of this enormous harvest of gold revealed the existence of many thousands of gold belts and districts, gold lodes and veins, of which the most remarkable, permanent [meaning 'persistent'] and greatest is the famous Mother Lode". Again, he says: "The Mother Lode is a vast system of fissure-veins with fillings of gold [as if Nature were a dentist] containing quartz, talc, lime, schist, serpentine, etc., [that "etc." saved us from the index of a treatise on petrography or mineralogy, or both] a complex of both igneous and sedimentary rocks [what is the matter with eolian formations; surely windy agencies might be dragged into the description with some appropriateness], which have undergone deep-seated dynamic and metamorphic alterations". So has the language of this gentleman's technology, which is metamorphosed English pseudomorphic after piffle. We expected the old yarn about persistence of ore in depth, and here it is: "The developments of more than 50 years have proved that, on each and every quartz vein lying in and on this central belt of the Mother Lode, those leading mines which have fortunately had the capital and the luck to be continuously worked, have never been bot-

tomed". Some of them, bottomed the pockets of their owners. But Eldorado county will do even better, says our writer, presumably a 'professor' in his own right and an 'expert' in the eyes of his uncritical acquaintances. "The veins of Eldorado county," says he, "have not been any more than merely scratched, and these magnificent, powerful, potential [he throws adjectives with the lavishness of H. G. Wells] producers of enough gold bullion to liquidate the world's war-debts, now lie awaiting capital to extract their vast wealth; they rest silent, eloquent [our scribe ought to imitate them in the eloquence of their silence] implorers, alluring the attention of men of courage, men of energy, and justifiable greed of gain" and presumably, shall we say, just to alliterate, of glorious gullibility? Then come several 'conclusions', each failing to abate the flow of verbiage. Among them we find the assertion that "the pay-ores in the veins are free-milling and cannot be worked out for 4000 feet of depth in 100 stamp-mills in 50 years". Which might be true if his estimate of a cost of $1.50 per ton could be confirmed. He attributes the idleness of the mine to "the prankish peculiarities of crank owners", and suggests that the property "is not a squeezed lemon but a virgin mine with its millions of valuable, incalculable treasures lying in Nature's safe-deposit vaults". Then, at last, comes the real conclusion, in which he states, in a grand flourish of words, that his "professional, mineralogical, geological opinion and his academic, economic, and financial view of the property is, it is phenomenal, illimitable, fascinating". All this is meant to be serious, and for that reason it is funny.

Silver

The Western miner ought to feel happy these days, for his favorite product has appreciated to a figure that is above the rate of coinage, making the metal in a dollar worth more than its face value. On November 24 silver touched $1.37½ at New York, the official price on that day being $1.35 per ounce. This was the highest quotation since 1872 and compares with an average price of 51.8 cents in 1915 and of 98.4 cents in 1918. Our silver coinage-rate is $1.2929, at which figure the dollar has the same value as coin and as bullion, but our smaller silver coins contain less silver proportionately than the dollar, namely, two half-dollars, four quarters, or ten dimes contain only 347.22 grains of pure silver as against 371.25 grains in the dollar itself. Therefore whereas the parity point is reached by the dollar when silver is $1.2929, it is not reached by the subsidiary coinage until the quotation for the metal is $1.3828. We see therefore that on November 24 even the subsidiary coins were already ready for the melting-pot. Moreover, it is a curious fact that the United States differs from other countries in having no law against the melting of coins, so that if the market-value of silver bullion should remain above the coinage-rate, the melting of coins would undoubtedly follow. The reason for over-valuing the subsidiary coins, by giving them less than their face-value of silver, was because, says Mr. George E. Roberts, formerly Director of the Mint, they were meant to be merely token coins, purposely over-valued in order that they might not be exported or melted; but they are redeemable at the Treasury in full legal-tender money.

On November 1, 1919, the Treasury estimated that the total stock of silver dollars in this country was $308,145,000, but of these dollars only those that have been held by the Treasury against certificates are of full weight; the others have become abraded by use, so that they would have lost a little of their original weight. However, the exportation of silver coins by private individuals is restricted by the law of April 1918 to transactions licensed by the Government, and we are informed that last week the Government stopped the export of silver from San Francisco to the Orient, then proceeding at the rate of a million dollars a day, except for the purpose of adjusting balances of exchange. The extraordinary demand of China for silver is explained largely by the fact that the War checked the normal movement of the metal to India from 1914 to 1918, and during that period the needs of India were supplied by shipments from China, which is now replenishing her reduced stocks, for which there is an enhanced demand on account of the depreciation of European paper moneys, as well as rupee notes. In 1916 the rising price induced the people of India and China to put their hoards on the market; they sold to the European governments; the price fell, until the selling stopped; the continued demand caused a rise; London was isolated by the German submarine campaign; it became cheaper to ship the metal from New York across the continent and over the Pacific to India, than through London and the Suez Canal. In this Oriental trade, San Francisco has a geographic advantage over both London and New York, therefore prices here were, and are now, at the best. Thereupon London, in behalf of the Indian government, approached Washington, and the Pittman Act followed in 1917. Silver was stabilized at 101½ cents. This permitted the United States to melt and ship 260,000,000 ounces to the Far East. The balance of trade in favor of China is causing a demand for silver, and various other factors have united in stimulating exportation of the metal to the Far East. Similarly in Europe the depreciation of paper money, the scarcity of gold, the paying of the soldiery have caused a scarcity, assisted there likewise by hoarding among the peasants. Great Britain and France have prohibited the exportation or melting of silver coins. Meanwhile production has continued to decline. In 1911 the world's output was 226,192,000 fine ounces. In 1916 it was only 156,626,000 ounces, this decrease being attributable largely to disturbed conditions in Mexico, where production fell from 70,000,000 in 1913 to 22,000,000 ounces in 1916, rising to 31,250,000 in 1917. Since then it has been increasing, thanks largely to the Real del Monte mines at Pachuca, and is now at the rate of about 45,000,000 ounces. In the United States production has decreased only slightly, in sympathy with the diminished output of copper, for 75% of our silver is a by-product from copper, lead, and gold mining. In 1918

the Anaconda copper mines, for example, yielded 10,976,905 ounces of silver.

During the year now closing there has been a notable stimulus to the mining of silver, as was to be expected. All over the West the old mines have been re-opened in the expectation of winning a profit from ore discarded in the years when silver fetched less than half its present price. In May 1919 the war-time embargo on exportation was lifted, the market was freed, although still under Government control, and silver had a chance to find its logical level. It is there now. To the miner the rise in silver is associated with the regret that the gentlemen in Mexico are so disorderly; he would like to return to the mining districts south of the Rio Grande, where he knows of hundreds of idle mines or abandoned mines that could be worked today with highly satisfactory results. To the miner the 'watchful waiting' of the Administration is most annoying; he itches to be picking and gadding in rich veins, even *hilos*, of argentite, proustite, stephanite, and all the other luscious 'ites that betoken the white metal. The Mexican dollar is at a big premium. The Mexican government is buying 50% of the mine output for its own use. The Mexican people can buy from Europe on enormously advantageous terms, placing their appreciated silver against the pitifully depreciated moneys of the old world. To be mining silver ore in Mexico would be heavenly, if only the *'istas* would cease from troubling and the *revoltosos* would but be at rest.

Who Said Thrift?

Subscribers to the Hoover dinner of the Institute at New York have received a statement of accounts showing that the cost of the affair was $11,800. Nobody, least of all the present writer, would begrudge any honor to Mr. Hoover, but it seems proper to protest against the unseemliness of spending nearly $12,000 on a dinner to the man who worked so nobly in behalf of the famished and destitute peoples of Europe. Many members of the profession subscribed to the fund for Belgian children in 1916 on the understanding that $12 would suffice to provide one good meal per day for one child during a whole year. Thus the banquet to their benefactor represented dinner for a thousand hungry children during an entire year. In San Francisco we heard Mr. Hoover at a dinner that cost only $3 per cover; in New York it cost $10. The extravagance was all the more out of keeping with the character of the guest and of the occasion, because Mr. Hoover cares little about the frills and would have been just as pleased to talk to an assemblage after a sandwich and a cup of coffee. It is curious to see such things done when the public is being bombarded by the Government with appeals to exercise thrift and buy War Savings Stamps and Treasury Savings certificates. For example, we have a circular from the War Loan Organization quoting a speech by Mr. B. F. Irvine, of Portland, in which we are told: "Expenditures are terrific. The people are on a mad financial spree. Normal business principles are dead. Thoughts of thrift are forgotten. A man's hat at $20 has become a commonplace. . . . Nothing is stable. New York manufacturers and jobbers no longer quote prices of goods on future delivery. . . . The public comes along and pays whatever is asked. And so the pyramiding goes on." This is true, and it should cause all good citizens to determine to do their part in checking this orgy of spending. Unfortunately the Government itself sets a bad example. It spends its money without formulating a national budget. It threw away about four billions out of the 25 billions spent in the War. The lavish scattering of money enriched certain classes of people, from ship-workers to manufacturers, who are now spending like drunken sailors the money contributed by the citizens of this country in the form of Liberty bonds and taxes. A day of reckoning must come. The blind editor in Portland whom we have quoted says that at the age of 65, ninety-seven out of every hundred persons in America are dependent upon relatives or charity for their daily bread; fewer than 6,000,000 American families own their own homes; one person in every ten of those who die in our large cities is buried in a pauper's grave. Any poverty in this rich land is due mainly to thriftlessness; poverty means dirt, ill health, unhappiness, discontent. It is a crime against civilization that we should be spending $12,000 on a banquet or $20 on a man's hat when millions are suffering and dying in Europe for lack of fuel and food, and, what may be even more to the point, millions are suffering in our own land from similar causes; for the orgies of the profiteer, which includes the $10 per day shirker in the dockyards and munition factories no less than the manufacturer and contractor at cost plus 10%, afford a violent contrast with the poverty of the school-teacher and the want of thousands of unorganized working people from New York to San Francisco. The strikes and other troubles are due in part to this exhibition of extravagance, which is bound to unsettle the minds of the uneducated. Some workmen get their $200 or $300 per month and buy silk shirts, gramophones, and automobiles, while others, unassisted by a truculent and irresponsible leadership, receive hardly enough to meet the cost of living, which is rising continually owing, in part, to the extravagance of the lucky ones. Educated men show no greater restraint than the uneducated; the mania for reckless spending is almost epidemic; it is worse than the intoxication caused by alcoholic liquor, for it is general among the women as among the men. The prices for women's dresses today reflect the utter unreason of the purchasers. It can end only in one way: in a collapse and a crash that will involve immeasurable unhappiness and disorganization. Just when the world at large is disorganized by the effects of the calamitous war, and when we are talking, at least, of the urgent need for the systematic reconstruction of industry in this country, there comes this mania of extravagance, rendering futile any wise measures of rehabilitation and any humane effort to settle the difficulties arising between capital and labor. It is time to pause and think seriously, lest we be caught in the reaction that assuredly is coming.

State Compensation Insurance

The Editor:

Sir - Because of your editorial comment, indicating that you are not entirely in sympathy with impressions of the State Compensation Insurance Fund given by Mr. George E. McClelland of Sonora in a letter published in your issue of November 29, I feel that in justice to your paper as well as to this Fund a reply is in order.

Mr. McClelland first refers to a Mr. Eaton, who claims to have had a "very disagreeable experience with the Bureau regarding his garage-men's insurance". A search of our files fails to reveal any record of insurance having been issued to cover anyone by the name of Eaton in a garage business. We would welcome an opportunity to answer a specific criticism with particulars.

The Mine Safety Inspectors of the Industrial Accident Commission work entirely independent of the State Compensation Insurance Fund, and we must dispute Mr. McClelland's statement that insurance could not be obtained until $1200 had been spent for off-setting the ladder-line. It is true that we might rightfully refuse to issue insurance to any risk if we knew that the employer persisted in a failure to comply with the necessary safety rules.

Your correspondent states that he could secure no information as to how to apply for State insurance at Sonora, the county-seat. Surely he must have known that a postal card or other inquiry directed to any State Department at Sacramento would bring a reply in case he did not happen to know that the main office was at San Francisco.

The law prescribes representation of this Fund as a duty of City and County Clerks and Treasurers, but in practice this is unsatisfactory, as the duty is not welcomed by officers who have more pressing local duties to perform. We hold that the agency system is entirely unnecessary in a State where insurance is compulsory, and where that unnecesssary item of overhead can be saved for policy-holders merely by the use of a postage-stamp.

Mr. McClelland's letter offers further evidence of the fact that this Fund is continually subjected to unfair competition through deliberately untruthful statements by insurance agents. I have the manual of rates before me which was followed by corporate companies under the Roseberry Law, before the State entered the business. That manual shows that the rate for compensation insurance was $8.40. The rate established by the companies (and followed by the State) in 1914 was $7.86. Toward the end of the first year this Fund gathered independent statistics and adopted a rate of $5. This action forced the companies to adopt the same rate, even though their bureau in New York insisted that it was inadequate. The rate has since been increased because of changes in the law which have added to the compensation and medical costs.

Since the rating statute was enacted which holds all insurance carriers to a certain minimum rate for each classification for protection of the solvency of insurance carriers and the ultimate protection of industrial workers, several increases in rate have been proposed by insurance companies. We have considered that the increases asked for were unjustified, and have consistently opposed their approval by the State Insurance Commissioner. While some increases have been approved by the Insurance Commissioner, he has not allowed the full increase asked by the insurance companies, and we hold that the Fund has been a consistent and material factor in keeping down the cost of compensation insurance, to say nothing of the large amounts returned to employers through dividends. These statements can be readily verified by reference to the public records, which conclusively prove that the statements which Mr. McClelland attributes to the "agent" are false.

I hardly think Mr. McClelland could have made a thorough survey of the situation in his county if he received the impression that no one in that county was insured by the State. Most all of the members of the California Metal and Mineral Producers Association are insured by this Fund, and we are carrying over 70 risks in Tuolumne county at this time, the large majority of which are mines. The latest comparative figures of the total mining business in the State, which are on file in the office of the State Insurance Commissioner, show that the total mining payroll of the State covered by insurance in 1917 was $4,764,891, and that of this amount, this Fund, in competition with many insurance carriers, covered a mining payroll of $3,451,128, or 72% of the total. The Fund is writing about 40% of the total compensation business in all classes, and these figures hardly bear out Mr. McClelland's belief that State insurance is not being made available and is not being taken advantage of by employers generally.

This Fund is in no way responsible for the difference in rate in California and Nevada. In the first place, it is unfair to compare rates without comparing the relative compensation costs under the two laws. In the second place, the Nevada Fund enjoys a monopoly of the business, and is not compelled to charge a 35% loading for expense in order to permit insurance companies to fairly

respect as is the case in California. It should also be borne in mind that the Nevada Fund has charged inadequate premium rates in the past and showed a deficit.

Your correspondent also shows that he does not understand the difference between a 'premium' and a 'minimum'. A minimum premium is an amount which is arbitrarily charged for a risk when the rate applied to the payroll produces a less amount than the minimum. When the State first began its competitive business with corporate companies the companies charged a $25 minimum for ordinary risks and usually charged a minimum of $100 upward for mines. The minimum premiums established by this Fund were very much lower and some of the companies have been forced to meet those lower minimums. These arbitrary minimum premiums are designed so that the employer with the small payroll will bear his proper share of the overhead expense. It costs practically as much to record, inspect, and audit the payrolls of the employer with a small payroll as it does in the case of the large payroll, and the minimum premium tends to equalize the contribution to the overhead expense.

For the benefit of such of your readers as may be interested, I might add that a telegraphic or mail inquiry to our main office at 525 Market St., San Francisco, is all that is necessary to bring full particulars to any employer seeking information about State insurance. We also maintain branches at Sacramento, Oakland, Fresno, Los Angeles, and San Diego.

C. W. Fellows, Manager.

San Francisco, December 3.

War Minerals Relief

The Editor:

Sir—Anent this much mooted question of reimbursement of those who went to more or less expense in connection with the demand for manganese, chromite, and other metals and minerals needed by our Government during the past unpleasantness, by the War Minerals Relief Commission. As an engineer, and at times a miner, and at all times a citizen striving to assist the Government and to reduce the cost of the essentials of living, I have been interested in this question and its discussion and although it may seem out of my province to attempt to judge, even for my own satisfaction, a question on which so many eminent authorities disagree, yet I would like to express to the many who did not enter the field of mining, concentrating, and shipping of these minerals during the War, my opinion in regard to some of the work done and its value to our Government and to ask some of those who are crying most loudly for reimbursement if they really, honestly, think that the Government, overburdened as it still is with war debt, should pay for their misguided errors.

Of the work done outside California in these lines, I cannot speak. Hearsay evidence is no evidence at all and I may only speak of what has come directly under my own eye and hand, so I will confine myself strictly to what I know to be facts.

For a great many years prior to the commencement of the War, Californian chromite was mined and shipped to eastern U. S. points. Some of this mining was done by the consumers themselves. They bought or leased claims, equipped and operated them, and shipped the ore to their plants near the Atlantic coast. It is safe to assume that they would not have done this had it not been profitable. The price of chromite was much less then than it is now.

A few years before the War commenced a Californian corporation desired both chrome and manganese in connection with its operations and employed engineers to examine many of the properties offered them, opened up a few of the many that were offered, and extracted some commercial ore. The pre-war conditions demanded a much higher grade of ore than was afterward considered 'good enough' and the price offered was very low compared with prices pending during the War. Mining conditions had necessarily to be very good indeed in order to make a profit.

During the War, but prior to the actual entrance of our country into it, there was a general stampede for chrome and manganese prospects. People who never before took interest in mining began to hunt prospects and get right busy mining, sorting, and shipping. Many of them sampled (?) their own ore and shipped it and were righteously (?) indignant when the sampling at the destination showed the ore not to be as represented, and, in many cases, not of commercial value. The volume of ore which could be cheaply mined but which was not of commercial value led many to experiment with concentration of chromite ores and some of the experiments met with success.

During the period of the War before the United States actually entered it, I was called on to make some examinations of alleged chromite deposits in the vicinity of some chrome mines which had been operated for many years and were then shipping East by rail. In connection with the examinations, I looked over these operating mines as well and found that they were not cobbing the ore as closely as I should have done had I been in charge. Questions in regard to this matter brought out the fact that they frequently, when mining high-grade ore, deliberately mixed country-rock with it as they stated "to keep it slightly below $25 per ton in value", as there was an advance in freight-rate on ore that went over this value. However, they were mining, hauling, and shipping it to the East coast at a profit.

One of the first successful attempts at concentrating chromite on a commercial scale was discussed with me before the work was started. The ore went from 10 to 20% chromite in its natural state and the promoter had pulverized and panned some of it and was confident that it would concentrate. The property was favorably located, and, against a whole lot of disinterested advice, he went ahead and built a plant which was successful and secured contracts for his product at an extremely advantageous figure. This plant, which had a capacity of 50 tons of ore per day, cost less than $10,000 to build in its entirety. It operated during the balance of the war period and for some time thereafter to fulfil its contracts. After the

price of chrome broke and contracts were hard to get on account of the stocks on hand in the East, it shut down, then opened up again to fill an occasional small order, and a short time ago the owner started it up to produce a few cars of concentrate for which he could get 55c. per unit f.o.b. a San Francisco Bay terminal. His concentrate averages better than 45% chromite and he is willing to make it for $27.50 per ton delivered. A few days ago he stated that he had another inquiry for a few cars and "guessed he would go down and start up the mill as it was easy money". This was a well-advised, well-carried out, legitimate mining and concentrating proposition and its owner is not running to Uncle Sam with a tale of woe and a request for reimbursement.

In the latter part of October 1918, I was called on to go into the mountains and 'rush' the work on a milling and concentrating plant for chrome ore which was then just being started. It was completed about a month later and was run but a short time, produced a good grade of concentrate, hauling and shipping conditions were good, everything favorable, but the price had broken and only existing contracts were being carried out. These had but a short time to run. Operators however, even at this late date, were assured by telegrams from the East that the "1918 schedule would be continued until July 1919". This plant cost about $35,000 (including the development of the mine) and I am sure of my ground when I state that the owners built it because they expected to make a profit by operating it. They were not purely patriotic, they expected prices to hold and a large profit to be made. They took a business risk; prices fell; they lost. They are making a claim against the War Minerals Relief Commission and will or will not be reimbursed. Which, I cannot say. I can state from my own knowledge, however, that a large portion of the material entering into this plant (and with many other plants the same conditions exist) was bought on open account from the merchants in the nearest town and is still unpaid for.

I recall also, at about the time this work was progressing, visiting another mill, built under most unfavorable conditions, miles from the ore it was supposed to mill and no way of getting the ore to the mill except by teams hauling over a steep, new, mountain road which became impassable after the first rains, on which a considerable portion of the labor as well as the material was unpaid and I believe is still unpaid. The workmen were duly impressed with the patriotic necessity by the promoter of the proposition and worked for weeks under bad climatic conditions only to be mulcted of their earnings. The plant never produced a car of merchantable concentrate or at least not over one car.

There are instances of the building of such mills before the alleged mines were opened up enough to show that there would be sufficient ore to keep them in operation sufficiently long to be sure that the profit from the concentrate produced would pay for the cost of the mill and the mining and milling.

I visited another mill a short time ago. It is said to have cost about $100,000. With the exception of about half a carload of concentrate lying on the drying-platform, there was no evidence that the mill had been run. Concentrators, etc., looked like new. I was told that there is a $15,000 mortgage on this plant and, if this is the case, the only hope of the holder of the mortgage seems to be in the Relief Commission, as the salvage would not cover one half that amount. This is one plant for which the Relief Commission is looked to for reimbursement. I cannot state that the showing in the mine warrants a mill such as this, nor can I conceive of anyone in their sober senses placing such a mill on a chrome mine intended only to reap the harvest of war-prices. The buildings, if properly cared for and painted occasionally, would last for 50 years. Under the ore-bins are massive concrete foundations, built for all time, concrete floors in the mill-room, in the concentrator-room, concrete retaining walls of the most massive type, the whole mill built with a most lavish hand and only for a 'war baby'. Uncle Sam is expected to foot the bill.

Within a mile or two of this plant is another which cost some $50,000 or $60,000, possibly shipped a car or two of concentrate, and now lies idle, while there is a market for 250 to 300 tons a month of its product at a price which would make a profit and reduce the cost of the claim against Uncle Sam were the owners not more willing to sit by and await the award by the Relief Commission rather than to work out their own salvation. They believe the Government will reimburse them so why run the mill and work and worry when they are sure they will be paid back their losses without the necessity of mining, milling, and selling their product.

If this is patriotism, it is of the "dollar variety".

San Francisco, November 30. MERCURY.

The Concentration of Platinum in Placer Mining

The Editor:

Sir—The inability of Russia to supply the increased market demand concurrent with war conditions gave increased impetus to attempts at the recovery of platinum from placer operations in the United States and Canada. The mining departments of the governments of both these countries gave liberal support to research work to foster the production of the metal. Unfortunately, an ample supply had made economic metallurgical research heretofore unprofitable, and any research had been confined chiefly to the improvement of refining methods on the crude metal and its associated metals, and what knowledge was available was scattered and fragmental.

At this time I was connected with a hydraulicking operation in a known platiniferous district of British Columbia, and gave considerable time and effort to the subject. It is with the hope that the publication of my results will lead to information being printed from others, that this necessarily curtailed summary of results is offered.

The preliminary work of testing was done with the pan and rocker. The first testing was done by rocking indi-

vidual measured cubic yards, and then panning the rocker concentrate to a bulk of one-half to three-quarters of an ounce, representing a concentration of approximately 80,000:1. An assay of this concentrate showed gold with traces of platinum. From a suggestion made by Mr. Klink, of Shreve & Co., the next testing was carried out in the same manner, but the panning concentration was reduced only to five pounds, from one cubic yard, or a concentration of approximately 500:1. The assay of this concentrate showed a remarkable increase in both gold and platinum. By this I do not mean that the actual metal-content per half-ounce of the 500:1 concentrate was in excess of the 80,000:1 concentrate. The figures, however, when expressed in value per cubic yard, showed an average increase of 4 in gold, and an increase in the platinum from traces to an appreciable amount.

The investigation of machinery that could continuously concentrate the bank of gravel in connection with, and without impeding, hydraulic operations, led to the adoption of:

First, a set of under-current bars, 36 in. long with ¼-in. spacing for screening the material traveling through the sluice.

Second, a hydraulic elevator for elevating the screenings to a dewatering hopper.

Third, two Neill jigs for the first step of concentrating, and handling the large capacity discharged by the elevator.

Fourth, one Overstrom Universal table to each two jigs.

With this equipment the sluice-screenings were worked, and the tailings returned by gravity to the sluice 40 ft. from where they were taken out, effecting a concentration of 150:1 on the screenings, and, based on the percentage of minus ¼ in. material per cubic yard, a concentration of 600:1 on the gravel.

The experimental equipment proved mechanically efficient. One unit, as above, turned out an average of 2000 lb. of concentrate per diem.

Contemporaneously I did some experimental work to determine the most economical method for the extraction of the valuable metals. Any known method, patented or otherwise, that came to my attention was given fair consideration, and in many cases a trial.

Flotation resulted in a simple separation of the sulphides, principally iron.

Magnetic classification yielded a gradation from clean magnetite on No. 1 magnet to clean pyritic tailings.

Electro-amalgamation proved inconclusive.

Matte-smelting apparently resulted in an incomplete extraction.

Electric smelting gave the only definite result when the concentrate was smelted in combination with either a copper or silver ore.

In ordinary laboratory assays the only consistent results were attained by the use of comparatively small quantities of litharge and silica, using equal quantities of litharge and silver chloride, heating to quiet fusion in the gas-furnace, and completing the melt in the electric furnace before pouring.

In this may be embodied the explanation of the wide variation of assay-values on so-called black sands in general; that at ordinary furnace temperatures the finely-divided metals of the platinum group form silicates with the silica in the flux that can only be broken up by the additional heat of the electric furnace. Let the experimenter who doubts this take a known weight of pulverized platinum and introduce it in an ordinary assay-charge and compare his recovered metal with the original amount.

It is with the hope that other investigators, not of the alchemistic variety, may shed more light on this interesting subject that the above is written.

Hydraulic, B. C., December 1. K. C. Laylander.

Mr. Ingalls and Walkerian Economics

The Editor:

Sir—Although Mr. Brinsmade's exhaustive criticism of Mr. Ingalls' address on economics undoubtedly would be frowned down at a meeting of a dignified society or would be refused publication in the ordinary conventional periodical, on the ground that it does not stick to the rules, it makes interesting reading—as do most of Mr. Brinsmade's articles. Mr. Ingalls' economics are representative of the New Yorker who associates with financiers and high officials of industry. His pronouncements are exactly the type of philosophy that floats about Manhattan offices. Part of Mr. Brinsmade's objection to Mr. Ingalls' views undoubtedly comes from his not agreeing with this New York type of mind; and in that, of course, he voices the sentiments of many engineers in the West.

The New York business-man believes implicitly that life is strictly a survival of the fittest, as Mr. Ingalls suggests; and that no sentimentality or other nonsense should be allowed to interfere with the great law of supply and demand—in fact, that all such interference only operates to make commodities cost more to the consumer. New York business firms figure things out in hard facts, much as Germany did, and let Napoleon's "great imponderables" take care of themselves—which they occasionally proceed to do. The typical business-man neglects to notice that even in biology things do not always go according to the rules; or rather that there are other rules, such as the rule that too highly specialized and too restricted types fail and die off. Mr. Ingalls' assertion that any objections made by the people at large against the leadership of those on top reacts to the harm of the foolish ones sounds like the German dicta to the Belgians, which have now been proved to have been in bad taste.

Mr. Ingalls' address had impressed me differently from the way it impressed Mr. Brinsmade. It seemed to me a sign of a disposition at least to consider the point of view of the other fellow. At any rate it appeared to admit that there is another side to the question, which is a considerable concession, everything considered.

P. B. McDonald.

New York University, November 11.

Short Cuts in Mine Surveying—III

By DOUGLAS WATERMAN

The 500-ft. tape is of great assistance when measuring vertical shafts as well as all distances greater than 100 ft., especially when the ground is sloping. Horizontal and vertical distances between points may be obtained by measuring the inclined distance and observing the vertical angle, whereas, with the shorter tape, levels must be run to determine the difference in elevation, and the horizontal distance measured by 'breaking tape', a tedious method, and one in which the chances for error are greatly increased.

Owing to the fewer number of operations, the labor involved in carrying points down a vertical or inclined shaft is greatly lessened, and the accuracy of the survey increased by using the longer tape.

A tape of this length must be stretched tightly between points in order to eliminate the sag. This is best done by passing the tape over the right shoulder, and either taking a turn around the body with the slack, or holding it against the left side with the arm extended so that the strain will come on the shoulder and back. In this position any desired tension of the tape may be obtained.

The use of the 500-ft. tape may be easily understood by following the various steps in the operation of carrying a line down an inclined shaft. The instrument is set up over a point previously established at the collar of the shaft, in such a position that a sight may be taken down the shaft as well as a back-sight to a permanent or known point on the surface. The helper fixes a transit-point in the shaft in an advantageous position for future use, as at a station or change of angle in the shaft, which will necessitate a new set-up. If the shaft is timbered, a staple may be set in a cap, from which a plumb-line is suspended in exactly the same manner as in the survey of drifts underground.

The helper signals by waving his candle that all is ready, and illuminates the plumb-line to enable the instrument-man to turn the horizontal angle between the known point on the surface and the new point in the shaft. After turning the double angle the central wire is brought to cut a certain point on the plumb-line, which may be the point of the plumb-bob itself, a pelet of candle-grease, or a button strung on the plumb-line.

The vertical angle is read with all possible exactness, as this enters into the calculations of horizontal and vertical distance. The measurement of the slope-distance then follows. The tape is stretched as tightly as possible between the two points; that is, the point on the plumb-line from which the vertical angle was read, and the horizontal axis of the instrument.

The exact distance to the centre of the horizontal axis of the instrument is determined by the transit-man by holding the tape at this point firmly grasped between the thumb and finger of the right hand. When the strain is released he measures with a pocket-tape from this point to the nearest footmark, and makes the necessary addition or subtraction in feet, tenths, and hundredths. Careful measurements of 'height of instrument' and of 'height of point' complete the operation.

In this connection it may be well to explain the use of the auxiliary telescope, which is employed when the inclination of the shaft is too steep to permit a sight with the main telescope. The auxiliary telescope is attached, preferably to the top of the instrument, and balanced by the counterweight furnished for that purpose. It is lined in with the main telescope by sighting on the plumb-line or the corner of a building, and thereafter is used in exactly the same manner as the main telescope. The slope-distance is measured as usual to the centre of the horizontal axis of the main telescope, while the vertical angle is measured from the axis of the auxiliary telescope. This necessitates a certain correction in the observed vertical angle as follows: The distance between the axes of the two telescopes divided by the slope-distance, equals the tangent of the angle that must be added or subtracted from the observed vertical angle before making the calculations for vertical and horizontal distance. If the vertical angle is a minus angle, the correction is made by subtracting, and if a plus angle, by adding. The distance between the axes may be measured directly on the instrument.

It often happens that while it may be necessary to use the top telescope in back-sighting up the shaft, the minus angle may be taken with the main telescope, thus avoiding the calculations just described. The procedure in such a case is to use the top telescope in turning the horizontal angle, after which the horizontal cross-wire of the main telescope is made to intersect the point, and the vertical angle read as usual.

FIELD-BOOK. Engineers' field-books are generally in blank form, the arrangement and style of headings being left to individual choice. Their use is apt to occasion a lack of uniformity in the notes if filled in by different engineers, which impairs their usefulness for purposes of reference.

The form of transit notes here presented should recommend itself to engineers, as it combines in one book a form admirably adapted for mine surveys, as well as general field-work, and covers every requirement for recording surveys above and below ground. The headings are for the most part self-explanatory, but a detailed explanation, accompanied by a few examples, will serve to emphasize their range of application.

The first column 'At Station', of course, is the point where the instrument is set up. This may be any estab-

last station in an underground survey, any point in a traverse, or a turning-point in a series of levels.

'H. I.' as usual denotes the height of the instrument, but in mine surveys it is also used to record the distance of the axis of the instrument below a point in the roof, which would then be designated by a minus sign, or by a plus sign if the instrument sets above the point.

'Station sighted to' is used in place of 'back-sight', as this may be any point from which an angle is turned, or an elevation read; the heading is therefore more explicit in this way.

The heading 'Slope Distance' is required for underground work, although it may be used for surface-work as well where the slope is measured with the tape. This column also has the heading 'Stadia Reading', in which the reading of both wires is recorded.

The 'Vertical Angle' is recorded with the plus or minus sign as the case may be.

'Vertical Distance' is calculated. 'Horizontal Angle' (L-R), and 'Magnetic Reading' are self-explanatory.

The next column is used to record the calculated bearing as determined from the horizontal angle, or the deflected course starting from an assumed meridian, both of which are true courses or bearings, as distinguished from the magnetic bearings.

'Horizontal Distance' is either measured or calculated from the stadia reading, or from slope-distance and vertical angle.

The 'Roof to Floor Distance' will give the height of the drift that is of use in drawing cross-sections of the workings.

'Offsets left and right' are necessary where an accurate platting of the drifts or stopes (called contours by some engineers) is required.

'Height of Point' is the distance above or below the level line of sight, and is recorded plus or minus in the notes.

Under 'To Station' is recorded the station or object to which the instrument is directed and observations taken, a detailed description of which follows under 'Remarks'.

A column is provided for 'Co-ordinates' if these are used.

MINE PLANS may be platted according to the co-ordinate system, by bearings, or a combination of both methods. The courses may be referred to the true meridian, the magnetic, or an assumed meridian. The choice of the best method to adopt will usually be governed by the prospective magnitude of the mine-workings, by a consideration of possible legal difficulties, and, finally, by the system to which the engineer is accustomed.

The co-ordinate system ensures more accurate platting than can be done with the protractor, as the errors are not cumulative, but it entails more office-work. Productive mines in many districts, and especially in the United States, are so often involved in legal disputes with adjoining claims, that it is well to be prepared for such a contingency, and employ every means for producing an accurate map of the mine. More often, however, the size and importance of the property will hardly justify the additional time expended on the calculations for co-ordinates, the platting by bearings being quite satisfactory.

It is advisable when important connections are to be made, as, for instance, with a new shaft or adit, to check the platting of the survey involved by working out the co-ordinates of the courses. Calculations of latitude and departure are also necessary when the accuracy of previous work is to be checked by a closed survey; but in general the platting by bearings will suffice.

The instrument work, as previously stated, involves the reading of the horizontal angle, from which the true course is later calculated in the office. While the reading of the needle, as a rule, will furnish a check on the calculations, it is not safe to rely upon this check when the bearing is within a few degrees of the cardinal points of the compass. For example, the true bearing might be N 2 W, while the needle might read N 2 E, there being 4° of local attraction at that particular station. The same thing might occur when the bearing is nearly due east or west. It is best therefore to check the bearing by the angle itself, which is in every case doubled, while the needle is read but once. This is done after the calculated bearings of the courses are platted on the plan and an absolute check obtained as follows: The parallel-ruler is laid parallel to the trace of the line connecting the two transit-points constituting the back-sight, and the horizontal angle, if less than 90°, laid off on the protractor, the limb of which should then coincide with the trace of the forward course on the plan. The use of the protractor in this test requires an angle less than 90°. If the angle is more than 90° and less than 180°, subtract 90 from it, and with the protractor set at this angle lay it with its base at right angles to the parallel-ruler. The limb of the protractor should then coincide with the calculated course, as by setting the protractor in this position the mechanical equivalent of subtracting 90° has been performed. If the angle is between 180° and 270°, the subtraction to be made is 180°, which again leaves an angle less than 90°. The required acute angle can be read at a glance by the following rule:

If the obtuse angle is less than 180°, add 1 to the second digit; the angle being 167°, read 77°, which is 167°−90°. For angles less than 270°, add 2 to the second digit; thus for 240°, read 60°, which is 240°−180°. For angles greater than 270°, add 3 to the second digit, but read two places only; thus as for 280°, read 10° and not 110°. This is a simple rule by which the acute angle may be determined at a glance. If the platted bearings are always checked in this manner, any mistake either in calculating the true course or in platting can be discovered instantly.

DRAWING PAPER. The paper intended for a mine plan should be of a kind capable of withstanding the constant and hard usage to which it is sure to be subjected. There are specially prepared papers for this purpose backed with linen, which not only adds strength to the paper but prevents shrinkage in a changing climate. If the drawing is to serve as a working-plan of the mine, it is

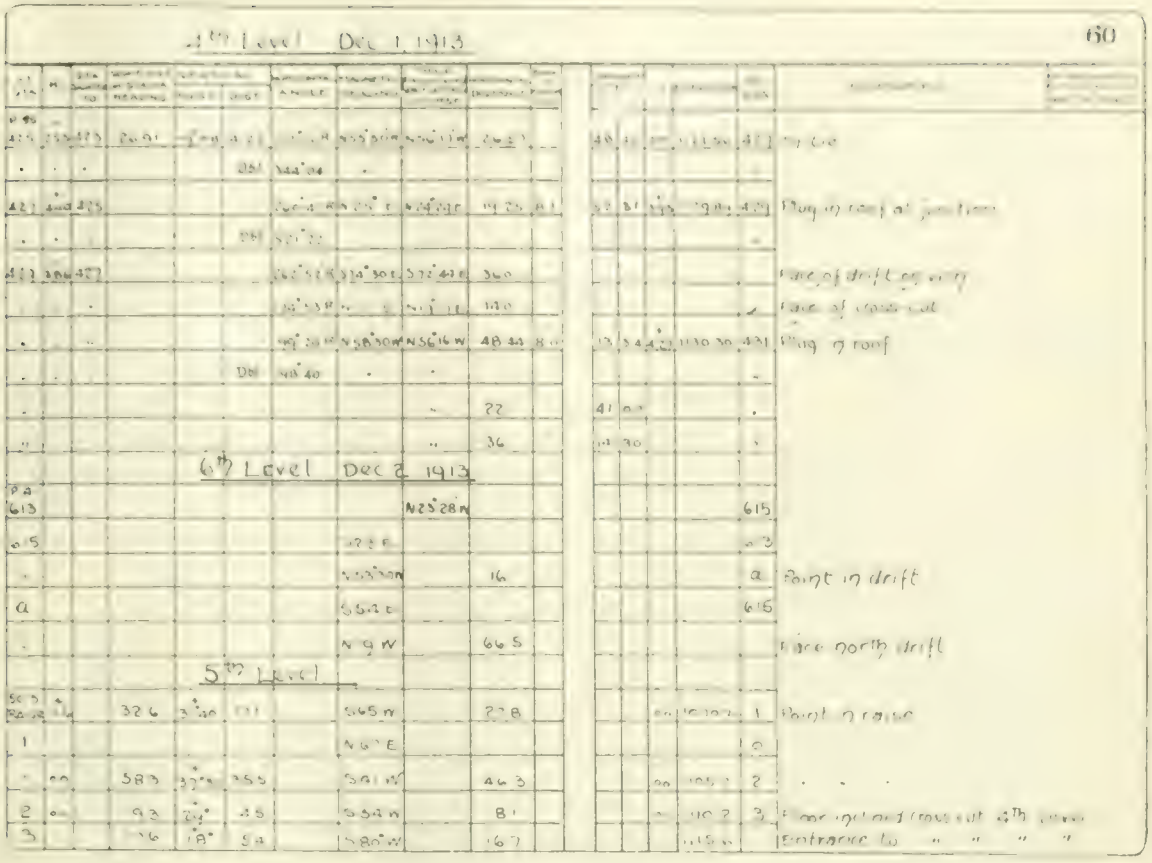


FIG. 6

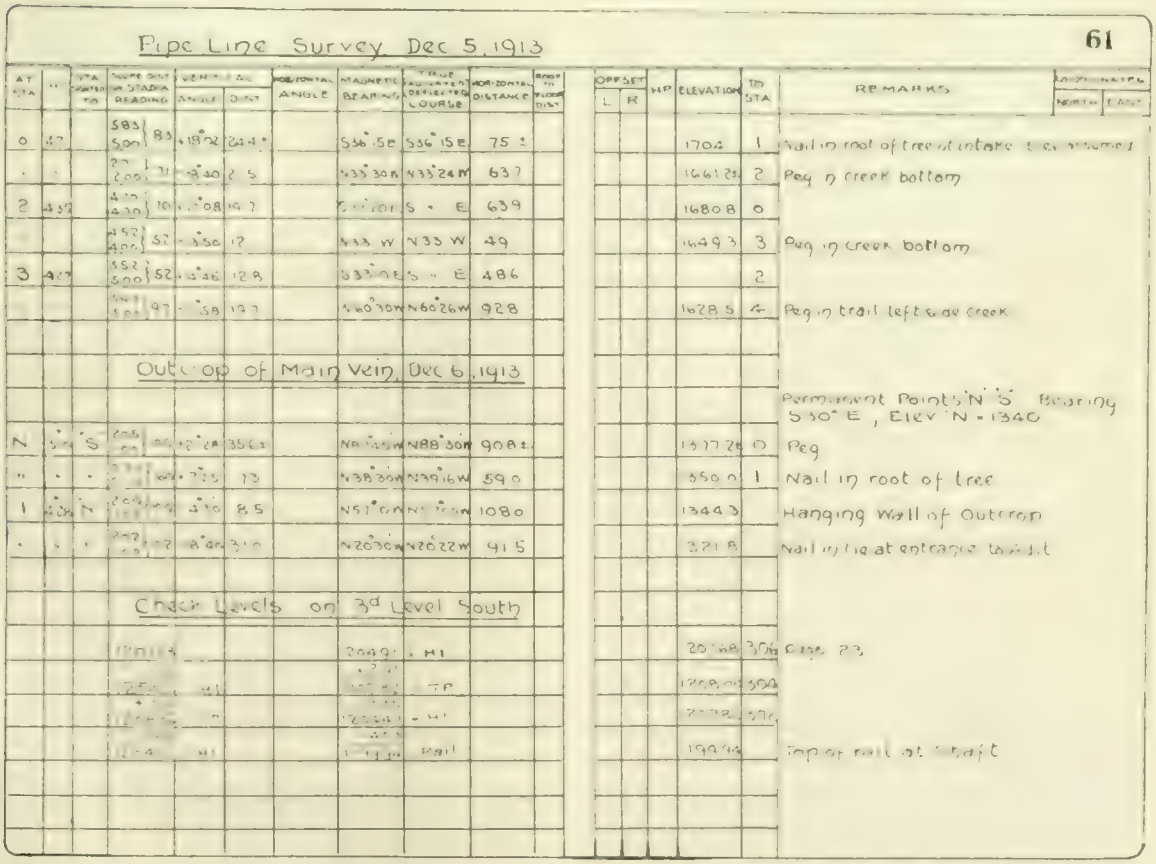


FIG. 7

TRANSIT-NOTES IN FIELD-BOOK

advisable to use such a paper in preference to a cheaper but less serviceable grade.

Coloring Prints. It adds greatly to the intelligibility of a mine map if the various levels and workings are colored, especially if the vein has a steep pitch and the plans of successive levels cross and re-cross each other. The coloring should be done with a light wash in order not to obscure lines or lettering. Dilute colored inks will serve, but a cheaper coloring matter in the form of a powder, from which large quantities can be made, may be purchased from supply houses. If these are not readily obtainable, the easily procured diamond dyes make an excellent coloring fluid, which by blending, will produce a great variety of colors.

Scale of the Plan. For the working-plan of the mine a scale of 30 or 40 ft. to the inch will prove satisfactory, as it falls just within the limits required for accurate plattings. Reproductions to the scale of 100 ft. to the inch are useful in supplementing monthly and other reports. A scale of 200 ft. to the inch will prove a convenient one for property and surface maps, but in this case the scale is largely determined by the scope and importance of the map.

Reductions may be made in several ways. With the aid of a pantograph a rapid reduction of a map may be made, but, as already stated, unless an expensive instrument is used, it is difficult to produce an accurate reduction. An excellent and fairly rapid method for reducing a mine-map is as folows: The compass directions having been chosen for the reduction-sheet, and the north and south line drawn, the paper is laid by the side of the larger map and oriented to correspond with its established meridian. If tracing-paper or cloth is used, it may be superimposed so that the meridians coincide. Starting from any point on the larger plan, the parallel-ruler is laid in the direction of any course that is to be transferred to the reduction. The ruler is then rolled along until it assumes a similar and parallel position on the smaller plan, and a line is traced in pencil. The distance is then scaled with the proportional dividers, previously set to the scales of the two plans, and transferred to the reduction.

If it is a succession of points or a series of courses or directions not traced on the plan that is to be transferred to the reduction, it is necessary to draw the connecting lines on the large plan as well as on the smaller, in order to identify the termination of the several measurements. An accurate reduction or enlargement may be made by this method.

Enlargements or reductions of surface maps can be made quite easily by dividing both sheets with light lines into small squares, the size of which are in proportion to the scales of the two maps. It is then a simple matter to locate the position of roads, creeks, fences, etc., by noting their position with respect to the sides of the squares. Proportional dividers may be used to measure distances or the topography sketched in, judging relative distances with the eye.

Tracings, if intended for much handling, should be made on cloth, but there are excellent tracing-papers that will serve for all other purposes. Tracing-paper is much cheaper than cloth, and in a moist climate will retain its transparency longer.

Printing-Paper. Blue-print paper is much used for plans of buildings, mechanical drawings, and surface-plans. For mine-plans the black-line print is preferable to blue-print, as additions can be drawn in black lines and the print colored if desired. It has the disadvantage of being rather brittle, the process seemingly destroying the paper. Not much trouble will be experienced on this account if the print is intended for office use, but it does not stand folding and handling in the mails as well as the blue-print paper. Cloth prepared by this process is entirely satisfactory, but is rather expensive.

If the co-ordinate system is used in platting it is convenient to have the plan ruled off into squares of, say, 100 ft. on a side. If the platting is by bearings, the plan may be ruled with a few light lines parallel to the assumed meridian. These will serve as a convenient base-line when using the parallel-ruler.

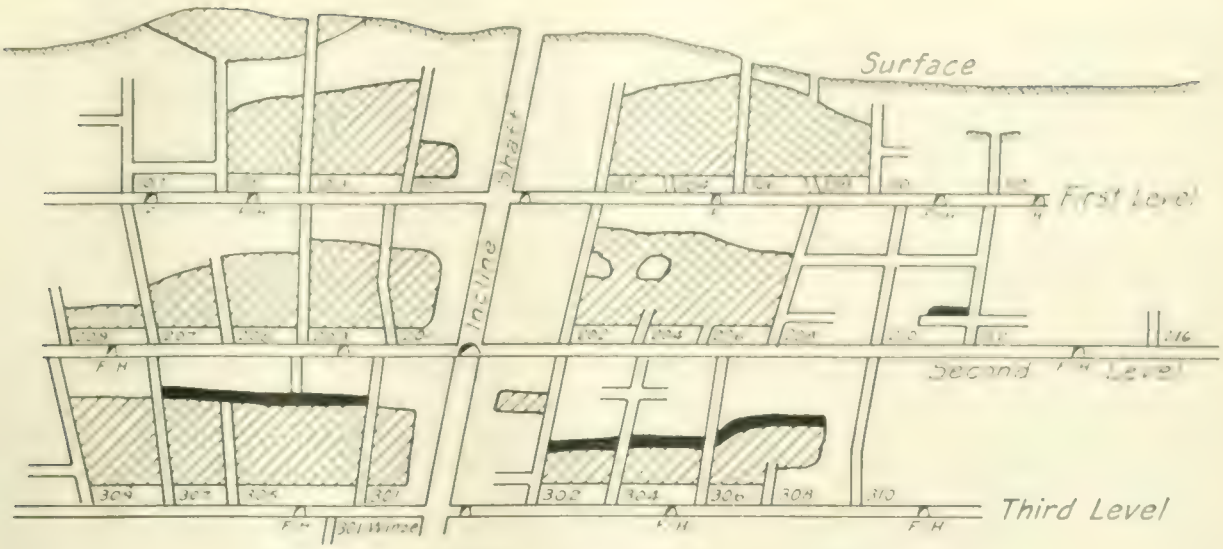
On the working-plan the courses of raises and winzes are indicated by parallel lines, one solid and the other dotted, to distinguish them from drifts and cross-cuts. On the reduced plan it will be found less confusing if both lines indicating the course of raises are dotted. The survey of development work, as long as it is carried with the compass, should be traced in pencil, but it may be inked in and colored as soon as the instrument survey is completed.

A longitudinal section of the mine is as necessary as the plan. It represents a section on the plane of the vein. Some engineers prefer to consider a section parallel to the general strike of the vein, and project everything on it. This is quite satisfactory where the vein has no marked change in the direction of the strike, but in other cases it is evident that such a section would represent the length of the vein and the distances between raises as being much shorter than they actually are. This makes it difficult to measure the area of orebodies directly, and gives a false picture of the section. These difficulties can be overcome by projecting onto a plane, which, while not necessarily following all the waves in the vein, is in a general sense parallel to it.

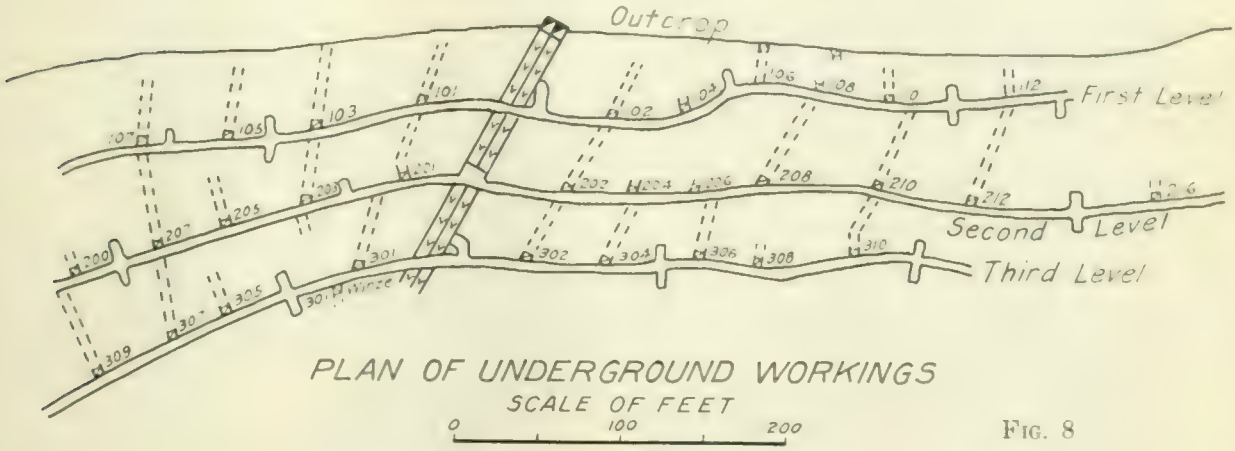
Fig. 8 represents a plan and longitudinal section of a mine developed by means of three levels and an incline-shaft with a pitch of approximately 60°. The shaded areas of the section represent the ground already stoped, the solid black being the portion stoped since the last estimate of the ore-reserves was made.

Such a stope-map is extremely useful in supplementing the monthly or bi-monthly report. If a black-line print is taken from the tracing the ore-reserves may be colored with crayon pencils, or light coloring fluids to represent the different grades of ore. The hatched areas may represent the ore stoped prior to, let us say, the first of January, and the solid black, the ore stoped up to the date of the last report.

By taking a print of such a map with him underground, the engineer can easily find his position in any of the stopes. Moreover it enables him to record the



SECTION ON PLANE OF VEIN
Horizontally developed along the strike



PLAN OF UNDERGROUND WORKINGS
SCALE OF FEET
0 100 200

FIG. 8

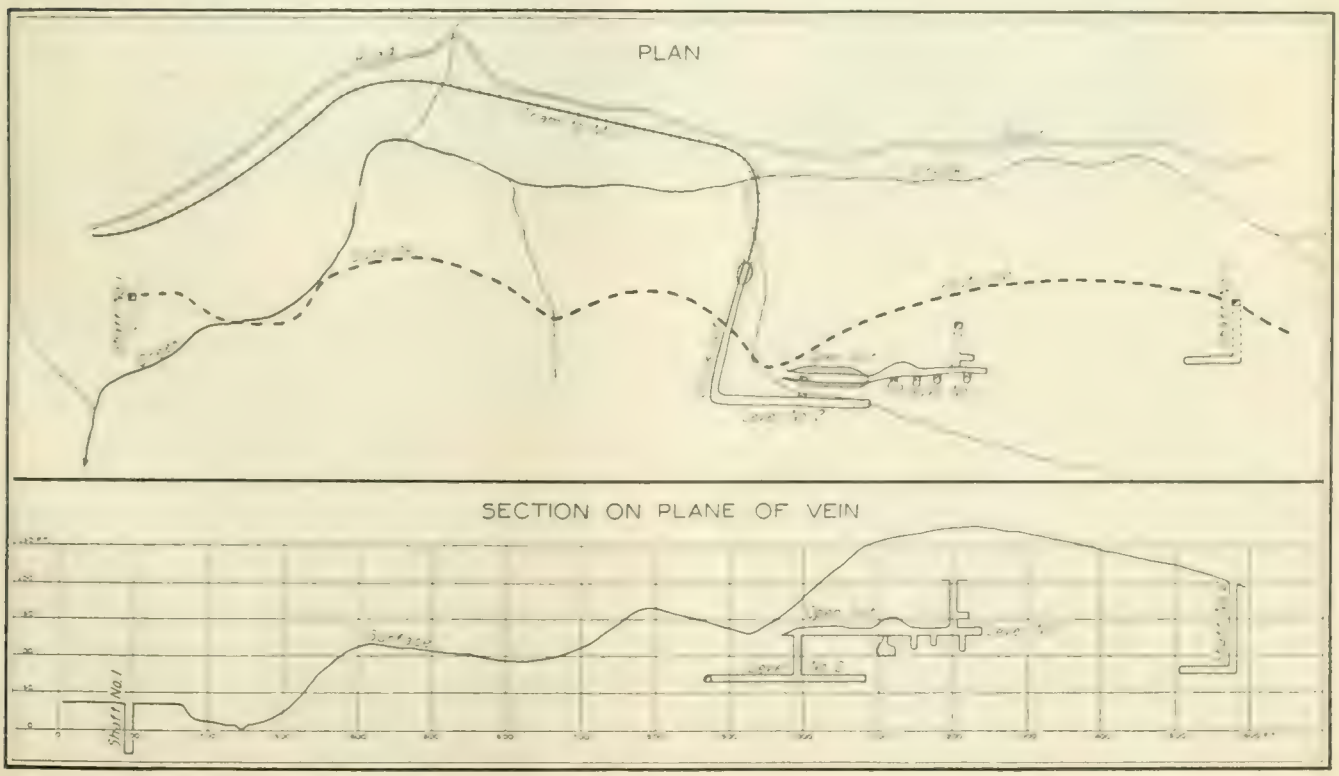


FIG. 9

present outline of the stopes quite accurately. Measuring down from the level above to the roof of the stope, he scales the distance on the print and sketches in the contour of the roof over the intervening space. A record is thus obtained of the outline of the stopes drawn to the scale of the tracing, to which it may be easily transferred in either ink or pencil.

Prints are now taken for the report, or for office use. The more recent stoped areas may be indicated by a wash of india ink. The areas stoped prior to the last report, and since the first of January, will appear as solid black on the print, and the remainder in hatched lines, the ore-reserves being colored as already described. Such a stope-map gives at a glance a comprehensive idea of the condition of the mine.

Fig. 9 shows a map suitable for the purpose of illustrating a report on a mining property as yet in the early stages of development. By scaling the sectional view in the manner shown, the reader can get a better idea of relative distances on the dip and strike of the vein, and can follow with little difficulty the engineer's estimate of ore-reserves and plans for possible future development.

Ventilation at the World's Deepest Mine

In the discussion of the report of the committee on working conditions in hot and deep mines, which was presented at the meeting of the Institution of Mining Engineers held at Birmingham, England, last month, Eric Davis gave some particulars of the problem at the Morro Velho gold mine of the St. John del Rey Company, in Brazil. As is well known, this mine is the deepest in the world, the lowest working being 6400 ft. vertically below the surface and 3650 ft. below sea-level. Luckily the rate of increase of rock temperature with depth is considerably less than that indicated in the report as being usual. Whereas the report gave 1°F. for every 70 ft., at Morro Velho it is only 1° for every 140 ft., although there are indications that the rate is increasing slowly for increased depth, so that for the lowest 2100 ft. the rate has been about 1° for every 119 ft. In the year 1913 Mr. Davis was entrusted by George Chalmers, the superintendent of the mine, with an investigation into this matter with a view to overcoming the difficulties and rendering the mine workable at depths considerably greater than those that had been reached. The only instruments he had were an aneroid barometer and wet-bulb and dry-bulb thermometers. Readings were taken at every level in the mine, and the results were plotted on diagrams having depth in feet for base. It was found that the dry-bulb temperature at any one point in the mine remains practically constant all the year round, but that the wet-bulb temperature undergoes considerable variations. For the same dry-bulb temperature and barometric pressure the wet-bulb temperature depends on the moisture content, and the tests he took showed that —the conditions being equal, and the mine being a dry one—the moisture content at any point underground, and therefore the wet-bulb temperature at that point, depends almost entirely on the moisture content of the surface air entering the downcast shaft. The whole question therefore boiled down to finding by analogy from the diagrams the volume of entrance moisture that would give wet-bulb temperatures in the working zone, below those fixed upon as the limiting value, corresponding to the 80°F. mentioned in the report. Then the temperature at which the air when saturated with moisture would have this required initial moisture content was that to which the downcast air would have to be reduced before it entered the mine. By hourly hygrometric observation at the surface, extending over a whole year, the worst conditions likely to be reached by the surface air became approximately known. Hence, knowing the volume to be dealt with, the amount of refrigeration necessary, power required, and so on, was calculated. It was found from the diagram that in order that the wet-bulb temperature in the stopes should not exceed 82°, which they had fixed upon as the maximum desirable, the initial moisture content must not be more than about 50 grains per pound of dry air, corresponding to a saturated condition at 45.5°F. The plant now being erected is capable of eliminating about 100,000 b.t.u. per minute. This corresponds to cooling the volume of air, 80,000 cu. ft. per minute, from an initial wet-bulb temperature of 72° (slightly below the maximum actual condition) to 43.5°, so that it will be on the safe side. As the surface wet-bulb temperatures varied during the year between 75° and freezing point, 32°, the refrigerating load on the plant will be a variable one. To meet these conditions the plant is being divided into six stages, each complete with its own motor-driven ammonia compressor, condenser, and evaporator. The number of sets running at one time will, of course, depend on the initial temperature. The air-cooling will be accomplished indirectly, as it would be deadly to have ammonia mixed with the entering air. Therefore the ammonia will be used to cool brine, which, in its turn, will cool the air by Heeman air-coolers. The whole plant is on the surface and deals with the downcast air before it enters the mine at all. The mine is absolutely dry, and, therefore, there is no fear of any great amount of moisture being picked up by the air in its course. The plant now being erected will cost about $200,000; the power required is about 500 hp. Provision is made for the addition to the original six stages of three further stages in case they should go deeper and still further cooling be required. The ventilation is effected by means of exhaust fans.

The Tolstoi district in Alaska includes an area about 12 miles wide by 20 miles long, which lies on the flanks of Mount Hurst. Most of the district is in the basin of the Tolstoi river, on the branches of which placers that yield gold and platinum have been worked for several years. The topography, geology, climate, vegetation, and animal life of the district, the producing placers, and the economic factors that affect mining are described by G. L. Harrington in Bulletin 692-F, U. S. Geological Survey.

Reminiscences of Prichard Creek, Idaho

By ADAM AULBACH

The operations of the Yukon Gold Company's dredge are now one mile west of Murray on what is termed the Prichard Creek flat, for the gulch here is about 600 ft. wide and the width continues to the western end of the town of Murray, where it narrows considerably. This flat was heavily timbered in the early days, principally with huge cedars, which made it an ideal spot during the summer and the reverse during the usual six months of winter, when the snow on the level lay from five to eight feet deep. The locality has considerable historic interest, for here was the scene of the dispute over the discovery of gold on Prichard creek, which electrified the country in 1883. I was on the ground in April 1884; so were the parties to the claim of discovery, A. J. Prichard and "Old Man" Gelatt. Prichard claimed to have made the discovery in 1882 in the centre of the gulch, about half a mile below Murray, where bedrock was about eight feet deep, covered densely with forest and close to the running stream. This would have made it difficult to get to bedrock to secure the gold said to have been taken out by Prichard himself. The party camped on the ground. At that time it consisted of three, Prichard, Gelatt, and Phil Markson. Two others had remained at what has since become known as Eagle, the first boom camp. Prichard was the leader, but he had initiated the others to such an extent that they separated after a day in camp, Markson going up the creek about a mile, while Gelatt wandered to the place where the dredge was built, 30 years later. Here the "Old Man" found gold, according to his own statement to me, high on the rim of the gulch where the bedrock was only two feet deep. He declared he washed several pans that day, but said that he went back to camp without saying anything about it. Next day he resumed work, and found coarse gold in paying quantities. He showed the gold to Prichard that evening and Prichard took it and put it into his pocket. Prichard denied this afterward and declared that he himself had taken the gold out of what he located as the discovery claim. Then Prichard took this gold and some more found elsewhere with him to the outside and shortly afterward the Coeur d'Alene placer excitement was born. I could never reconcile the two versions of the discovery.

MURRAY, IDAHO

Prichard was of a domineering temper; he had served in the Civil War, and was called Captain by his associates. His friends recognized him as the head of the prospecting

party and desired to give him credit for the discovery, even if he did not actually pan out the first gold. Therefore I gave him the honor of the discovery, although it was with some qualms of conscience. Gelatt was a man in the seventies, small of stature and of a gentle disposition; he had been a prospector since the early days of California and was about down and out. He had no desire to controvert anything that Captain Prichard claimed and was thankful to be allowed to retain the ground he had opened up as his own claim. He found that his claim covered shallow ground, but he made slow progress. The bedrock was spattered with gold and he cleaned up quite a stake, when two gentlemen named Porter and Henderson secured the claim by some process that aroused a bitter feeling among the miners in the neighborhood. Porter and Henderson took little notice of the sentiment against them; they hired a force of from 15 to 20 men and worked the ground with the utmost energy, guarding it with shotguns and rifles night and day. They cleaned up a large amount of gold, but whether Gelatt ever received any share of the output could not be learned, he being kept under close watch by Porter and Henderson. The miners in the meantime were worked up to a high pitch of excitement over what they considered a case of "jumping" and proceeded to arm themselves with what weapons they could buy or borrow, when it became suddenly known that Gelatt had disappeared, whether by his own free will or coercion was never revealed. We never heard of him again. The amount of gold taken out of the claim was not made known. Porter and Henderson worked the ground about a month after the disappearance of Gelatt and then likewise vanished. The Gelatt claim was the premier ground in the flat now being turned over by the dredge. However, the rim was the only part from which gold was recovered at that time; it was fairly coarse and well washed, being known as 'channel-run'.

The adjoining claims were a fraction owned by C. L. Jackson and Michael Melley; the O. K. claim, owned by Charles and Toft Simpson, Kid Price, and others; and the Last Chance claim, owned by Bill Stillwell and Bill Day. These claims were subsequently consolidated and patented

The Jackson-Melley fraction has the distinction of producing the largest nugget ever found on Prichard creek. It was valued at $270, and came from ground 12 ft. deep. Jackson died here some years ago. He was an old Californian and a typical miner. Melley is still in the flesh and a resident of Murray. The claim will be worked by the dredge during the coming year.

The O. K. claim was known as the tragic ground of Prichard creek. Early in 1884 it became the abiding-place of kindred spirits, mostly young and untamed men, who desired to pose as gun-men. What idle time they had from placer employment was devoted to revolver and rifle practice, entirely oblivious of the safety of their neighbors, or of those who passed on the trail through the timber. One of these youngsters, about 25 years old, whose name I have forgotten, except that he was called George, became known as an expert with the revolver, not only as to marksmanship, but as to quickness and rapidity of firing. This elevated him to the leadership of the gang. When a visit was made to Murray, which was practically every evening, the town soon became aware that the gang was all there, and everybody was careful not to get mixed up with it, although the provocation was pronounced in the dancehalls and gambling-houses. The gang terrorized the town while they occupied it, and in quitting they did not steal away silently, but 'shot the place up'. Tranquility, however, followed one of these violent demonstrations. The leader was called upon to exhibit his skill with an automatic, that is, twirling the gun on his right fore-finger and firing with every revolution at some object. Five shots went all right, but the sixth sent the huge bullet into the left shoulder of George. His ascendancy was shattered; so was his shoulder in a most horrible manner. The wounded man was carried to Murray by his companions, and the following day sent East to his relatives. He never returned. The spirits of the gang shortly afterward revived and it became known as the 'Kid Price band'. This was broken up by a combination of citizens, who notified the 'Kid' and his compatriots that they had got to the end of the rope, and that there might be a jerk to it. They vanished. Peace then reigned on the O. K. claim for several months, when a message reached Murray that Charles Simpson had shot and killed Lew Wyatt. These miners, however, had no connection with the Kid Price gang. They quarreled among themselves. There was no eye-witness. Simpson claimed self-defence. He was acquitted. Considerable gold was taken out of the O. K., although bedrock was 12 ft. deep. All the gold was coarse, up to nuggets of five, six, and seven ounces. Besides gold, the dredge, in its progress just below the O. K. claim, has already caught on its riffles several pounds of big soft-nosed bullets.

The Last Chance claim, lying immediately above the Gelatt on the rim, had the distinction of yielding two different qualities of gold, one regular 'channel' and the other bright and clean 'quartz' gold, the latter predominating. It was lower in value, however, and had to be separated in part before sale. The 'quartz' gold was scattered over the bedrock as if it had dropped out of a vein close-by. Pieces of several ounces in weight were not uncommon and were highly prized as specimens, selling above their weight-value. It is believed that the dredge quite recently cut the vein from which this quartz gold came. Of course, search was made for it by tunnels in the early days, but it could not be found. More may be revealed several hundred feet farther up the gulch where a huge vein crosses and can be traced for miles north and south. Singularly, too, the southern end is in limestone, and there the ore, in small seams, runs high in silver, assays giving 150 oz. per ton and only $15 in gold. A well-defined vein 30 ft. wide has been uncovered sufficiently to indicate its course. On the northern side of the gulch this 'ledge' has been located for three miles and gives out nothing but gold, except what silver usually

follows quartz gold. This vein unquestionably enriched Dream gulch and Missoula gulch, both of which were rich in placers, and these gulches, in turn, particularly Dream, poured out much of the gold that the dredge is now digging up. Dream gulch was also noted for its yield of nuggets and coarse gold in 1884-85. Very much later a 10-oz. nugget was taken from a shaft at the eastern end of the mouth of the gulch, and almost every nugget of any size carried the characteristic quartz of the big vein that forms the ridge between Missoula and Dream gulches.

Another historic feature of this part of Prichard creek, where the dredge is operating just now, is the Nye Pump enterprise, which was promoted by Col. Ramsey of Minnesota and H. C. Davis, assistant general passenger agent of the Northern Pacific Railroad in the latter 'eighties. It was Davis who got out and circulated the famous circular, which told the world that gold could be dug up like spuds on Prichard creek in the Coeur d'Alene mountains, near the Northern Pacific Railroad.

It had been demonstrated by the miners that no deep ground could be worked successfully on Prichard creek unless bedrock could be unwatered, and to meet this emergency Col. Ramsey contracted with the Nye Pump people of Chicago to ship one of their largest pumps to Murray and start it. It may be stated here that the pump had scored a success at Chicago in sucking sand out of Lake Michigan near Chicago in great quantities, but that was quite a different thing from the work to be done in a deep placer. This evidently was overlooked. However, an agent of the Colonel's, accompanied by his handsome wife, arrived at Murray in advance of the huge boilers and pump, with a letter of introduction to me, with the request that I locate the scene of operations on the best and most likely placer claim that could be secured for a proper test of the pump. I promptly obtained permission from the owners to locate the pump on the O. K. claim, already mentioned in this article. It was not too deep to bedrock; there was plenty of water for surface and lower operations; and there was also a fairly good chance to handle boulders with a windlass. The agent, a Mr. Argyle, a very young man and inexperienced, accepted the O. K. site and was awaiting the arrival of the machinery. One morning he called upon me and said he had concluded to give up the O. K. site and place the pump near the county road at the west side of the mouth of Dream gulch. This was done shortly afterward. When the local people woke up to the fact that the change of location had been made, there was some gnashing of teeth, but they could do nothing. The enterprise got under way and the machinery and pump worked well, until a depth of about 20 ft. was reached. Then the little side stream that had furnished the water for boilers ran dry and there was no water in the shaft for the pump. Here was a dilemma. A pump and boilers was brought to the spot at tremendous expense to unwater the mines placed high above the water-level. Relief was obtained from the California Ditch people. They laid a line of pipe from the ditch several hundred feet distant and sold water to the pump folk, who had come with the purpose of getting rid of water, not of buying it. The work thereafter continued spasmodically until a depth of 42 ft. was attained, there they found a sloping bedrock, dry as a bone. A short drift was run before the plant was shut down by Col. Ramsey in person. He paid the bills like a good sportsman and declared he had all the placer-mining experience he wanted. The loss was said, by the Colonel to me, to be above $40,000. The machinery reverted to Nye senior and his two sons, all mechanics.

I had satisfied myself that the Nye pump was not a failure under proper conditions and might yet succeed on Prichard creek to unwater some of the shallower ground. So I got Nye's permission to locate the pump on the O. K. claim. This was done, and a pit about 12 ft. square and 12 ft. deep was pumped out in the main channel. Boulders larger than a baseball were lifted by windlass. This was slow and expensive work. However, the water gave no trouble whatever. The pit yielded 17 oz. of gold, not half enough to pay the expense of sinking. Hence the Nye pump was added to the list of failures to wrest gold from the hard bed of Prichard creek, a feat being done so successfully by the Yukon Gold Co.'s steel dredge.

THE VALUE of tin ore produced from the tin-fields of New South Wales to the end of 1918 is $56,022,564. The value of the output for the year 1918 was $2,671,105, as compared with $1,818,592 in the preceding year, thus showing an increase of $852,513. In the Emmaville division the output was 873½ tons, valued at $934,928, as compared with 936 tons, valued at $688,941, in the previous year. The yield from the Tingha division was 601½ tons, valued at $739,708, as against 600 tons, valued at $440,676, in 1917. The output from the Wilson's Downfall division was 155 tons, valued at $167,602, as compared with 128 tons, valued at $84,502, in the preceding year. The yield from the Glen Innes division was 143¼ tons, valued at $152,336. In the Torrington division the production was estimated at 90 tons, valued at $89,057. The output from the Ardlethan division was valued at $376,584, as compared with $302,059, in 1917. The tin ore recovered by the dredges during the year amounted to 1253 tons, valued at $1,374,241, which was an increase of $482,913 in value over that produced in 1917. The most successful results were secured by the plants of the Emmaville division, the output of tin recovered amounting to 504 tons, valued at $539,598, as against 520 tons, valued at $383,655, in 1917. In the Tingha division the output was 444 tons, valued at $497,950, as compared with 403 tons, valued at $294,589, in 1917. The yield from the Glen Innes division was 123 tons, valued at $134,812, as against 132 tons, valued at $102,673, in the year 1917. In the Wilson's Downfall division the production was 145 tons, which was valued at $158,974, as compared with 118 tons, valued at $78,536, for the preceding year. There were in all 50 plants in operation during the year in winning tin ore.

Molybdenum and Molybdenum Steel

By W. E. SIMPSON

According to textbooks, the principal use of molybdenum is in the manufacture of tool-steel, but current reports as to its behavior in that capacity are so much at variance with each other that some difficulty may be experienced in forming a reliable opinion as to the exact state of affairs. Claims are made that the influence of the metal upon steel is similar to and several times more active than that of tungsten, but writers declare that its high price prevents it from becoming a serious competitor to the other steel-alloys in general use.

It is quite true that during the War, when cost was of minor importance, molybdenum did enter largely into the composition of various tool-steels, but diligent inquiry leads to the belief that its use for that purpose was confined to such times as the supply of tungsten fell short of requirements, and, if one may judge from information available, considerable doubt can be entertained as to whether at any time the resulting product really proved an unqualified commercial success. The highly volatile nature of the metal, as is well known, would naturally cause a change in chemical composition at each re-heating, and, consequently, an ever increasing alteration in physical structure must eventually result in the creation of a most unsatisfactory condition of affairs. The loss by volatilization involved in converting the mineral molybdenite into the alloy ferro-molybdenum is stated to be 15% of the metallic content. This gives a rough idea of the extent of change in composition likely to happen during exposure to a high temperature. At any rate no records are available of these tools having been in general use for any great length of time and we must assume that the chief utility of molybdenum must lie in some other way than in the manufacture of tools.

Investigators of fifteen or twenty years ago were unanimous in their outspoken condemnation of the metal under any conditions as a steel-alloy, and, so far as early day experiment went, the outlook for its commercial application was decidedly discouraging. A recent repetition of these investigations, however, has shown that the undesirable qualities imparted to the steel have been due, not to the molybdenum, but to the impurities with which ferro-molybdenum was then invariably associated; in fact, the real influence of molybdenum in steel-alloys is only now just beginning to be understood and future developments are likely to be of far-reaching industrial importance.

In the early stages of the War, reports were most consistent that the great German howitzers, which battered down the supposedly impregnable forts of Liège and Namur, and which were captured when on their way for similar work near Paris, owed their quality of endurance to the presence of a lining of molybdenum-steel. The American government, in order to test the value of these rumors, I am informed, caused chemical analyses to be made of the linings of two four-inch pieces of German field-artillery, and were unable to detect the presence of molybdenum in even the smallest traces. This is quite likely, and yet both reports may be perfectly correct. Lack of co-ordination of information in these and similar matters tends to give the impression that everything relating to molybdenum is surrounded with uncertainty from the exploration for the mineral to the marketing of the final product. Hence a situation has been created which to those interested is decidedly exasperating.

Certainly, wide experience in mine-examination work indicates that deposits of molybdenite, the chief source of molybdenum, are highly erratic both as to extent and richness, while market statistics show that the price of ferro-molybdenum has fluctuated within recent years between four dollars per pound and an offer that failed to evoke a bid.

It seems remarkable, for instance, that a comparatively large quantity of high-grade molybdenite concentrate should lie for many months at New York unsaleable and yet that there should be simultaneously, in the same city, representatives of European metal-brokers in search of quotations for the regular delivery of large quantities of this very self-same mineral. Yet it is a fact.

During the War a feeling existed among steel metallurgists of the Allied governments that the Germans possessed information regarding certain merits of molybdenum that could be turned to military advantage. Certainly statistics have shown that, in the three years preceding the War, the whole output of Queensland (Australia), then the world's greatest producer, went to Germany. The British government, therefore, as a matter of military necessity, bought every pound of molybdenite at sight, in order, not so much to use it themselves, but rather to prevent it from reaching the Germans. As a result, the price rose in Norway, on account of its geographic position, to over six dollars per pound.

Metallurgical research in England, during the War, showed that molybdenum, when added to certain steels, imparted not so much a hardening but rather a toughening property, which permitted the manufacture of plates possessed of great strength with comparatively little weight. The British War Department was not slow to realize that in this steel they had an ideal material for the construction of the famous 'tanks', and for that purpose it was used extensively, if not exclusively. It is always difficult to obtain information of a military nature but I believe that the steel plates of which the 'tanks' were manufactured contained, besides nickel and chrome, slightly in excess of one-half of 1% of molybdenum.

The alloy was so tough as to be unaffected by machine-gun fire at ten yards point-blank range.

No test could have been more severe than that to which the 'tanks' in France were subjected, and no better testimonial could be desired as to the super-excellent quality of the materials of which they were constructed than the record of their performances under the most trying ordeal imaginable. Many causes are attributed to the winning of the world war, but undoubtedly the work of the 'tanks' was a highly important contributing factor and the real secret of their efficiency was the part played by molybdenum in their construction. In the United States, credible report has it that molybdenum-steel was used for making the crank shafts of the Liberty motor, as well as for other parts of aeroplane construction.

Apart from war uses, the discovery of the toughening properties of molybdenum has led to its commercial application in several industrial directions where increased strength without excessive weight are important factors. Noteworthy instances of useful application, so far as the mining industry is concerned, include such articles as cam-shafts, cams, pitmen, and all parts of mining machinery where heavy duty is demanded. The applications for patents bearing on this matter are, I believe, so numerous as to give the impression that molybdenite mining is in for a 'boom'. One specific case is that of J. W. Weitzenhorn, who was granted a patent on December 10, 1918, for an invention which "relates to alloys for structural articles made of steel" in which "elements in proportion to their weight are required to possess great strength and toughness to resist stresses of various characters". He calls attention to the fact that with the usual steel-alloys from which articles are manufactured, if high ultimate strength and high elastic limits are desired, the effect of the necessary heat-treatment is to cause them to become hard and brittle. On the other hand, if toughness is required, then that quality is commonly "attained at a very substantial sacrifice of strength". According to the claim of the patentee, a most desirable combination of toughness and strength is secured with a steel alloy containing "about 0.35% carbon, 1% chromium, 0.15% vanadium, and from about 0.75% to 1% molybdenum".

It is common knowledge that the crank-shafts and many other parts of aeroplanes are made of molybdenum-steel but its greatest use in the immediate future seems to be in the manufacture of steel for auto-trucks, tractors, and automobiles. In this connection much credit is due to the industrial research-work of Child Harold Wills, so long associated with Henry Ford. He has been granted patents under dates of September 3 and of December 17, 1918, for certain steel-alloys in which molybdenum is the all-important factor. In his specifications Mr. Wills states that, "It has been impossible to obtain the super-excellent qualities of certain special steels without losing other properties absolutely essential to a commercial steel." He classes the various well-known alloys of steel for their defects and disadvantages: vanadium for "its liability to crystallization above certain narrow temperature ranges"; nickel "although having non-crystallizing characteristics superior to those of vanadium steel, is very hard to machine after heat-treatment"; [illegible] steels "possessing super-excellent [illegible] for example, as exceedingly high tensile strength and high elastic limit—are unworkable and most difficult, if not impossible to machine"; and chrome falls short in some respects "particularly as to crystallization and narrow range of heat-treatment".

Mr. Wills then goes on to say, "It is the purpose of my present invention to provide a commercial alloy-steel which at the same time has the super-excellent qualities of certain of the special steels and retains all the other characteristics necessary to bring the steel within the commercial class." Then he states:

"I accomplish the foregoing by the use of molybdenum as an added constituent to alloy-steels in fractional percentages ranging substantially from between 0% to 1% or a little higher."

Then follows a detail of experimental tests "which are fully supported in actual commercial developments".

Thousands of test automobiles have now been manufactured of molybdenum-steel and given the severest commercial usage with eminently satisfactory results. Accurate statistics have been taken of miles negotiated per gallon of gasoline, tire-life, oil-consumption, etc., and the particulars, I believe, are cause for much enthusiasm. The year 1920, according to current reports, should see the introduction to the public of the molybdenum-steel car, the superiority of which, it seems, has now been thoroughly demonstrated.

As regards details of automobile construction, I am credibly informed that an axle of molybdenum-steel has been twisted cold six times completely without showing signs of fracture. I do not know how far apart from each other were the twisting vises, as that would have some influence on the value of the test; for if these were close to each other, the pressure of the jaws would naturally tend to prevent any signs of fracture from showing, but, in any case, in this matter, confirmation is given to the assertion that the presence of a small quantity of molybdenum in steel undoubtedly does furnish a degree of uniform toughness that is truly remarkable.

Apart from use in the manufacture of aeroplanes and automobiles for which a steady demand can be confidently predicted, it seems to me that the scope of molybdenum-steel will be extended in degree to all other steel-consuming industries, although I am not prepared to endorse the opinion of some optimists who look to it replacing, to some extent, the other well established steel-alloys, such as nickel. Even if further metallurgical research were to hold out the hope of such a possibility, its realization is unlikely, if for no other reason than that an adequate supply is not available. "The future of molybdenum," said a British steel expert to me a few weeks ago, "depends on two factors, namely, assurance of supply and price."

As to supply, no molybdenite property at present known can offer, say, 50 tons per month, whereas the

nickel-bearing orebodies are so large that during the War no difficulty was experienced in extracting from one shaft alone a total of 5000 tons of ore in one day. As a competitor of, say, nickel, I do not think that molybdenum has any possibility whatever but, as a valuable auxiliary, I believe that it will fill a most important position. Its action intensifies the excellent qualities of other important steel-alloys and eliminates the imperfection with which their presence is generally associated. Special steels in the composition of which nickel, chromium, or vanadium plays an important part, are handicapped with an extremely narrow range of temperature in heat-treatment beyond which their high-grade qualities are seriously impaired. The percentage of loss from this cause is high, consequently these steels are expensive. Molybdenum is the corrective. Its range of temperature in heat-treatment is great. Its function is to prevent segregation and crystallization, to promote uniformity of texture and secure a degree of toughness in steel that is always more or less lacking in the alloys of more common use. It thus exhibits the quality of the high-grade nickel or vanadium steel at a cost only slightly in excess of that of the ordinary article.

As regards revenue to the miner, past records have shown that on one occasion when a sale of molybdenite had to be effected, regardless of sacrifice, the price fell to about 25 cents per pound of MoS_2. In these later days of higher prices, it seems unlikely that transactions will be consummated at less than twice that figure, and the tendency, I fancy, will be for a mean level in the neighborhood of 70c. or 75c. per pound of contained molybdenite. The demand for molybdenum-steel should take precedence over that of ordinary structural steel for all purposes in which an additional cost of say $20 or $30 per ton is warranted by the use of material possessed of those super-excellent qualities to which reference is continually being made in the various patent specifications.

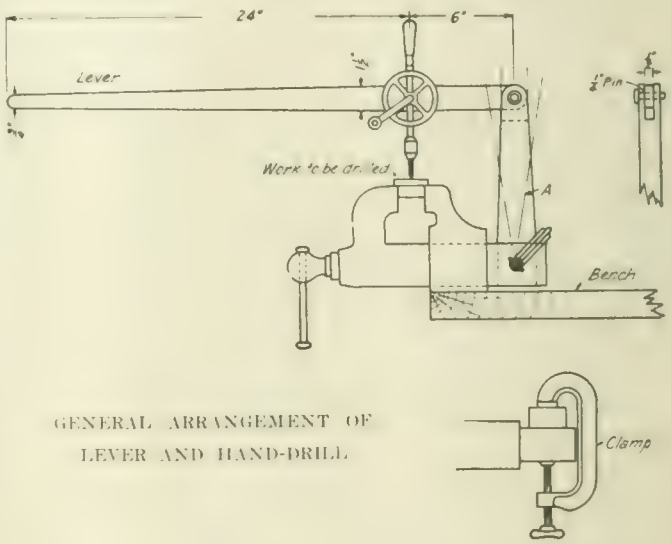
Although the molybdenum ore and metal market quotations are at present classed as "lifeless", "nominal", etc., they will, I predict, before long, show signs of considerable activity.

THE PETROLEUM produced in Alaska is derived wholly from a single patented claim in the Katalla oilfield, according to the U. S. Geological Survey. The old wells on this claim and the refinery were operated as usual in 1918. Two new productive wells were also drilled in the Katalla field. The total production in 1918 was somewhat larger than in 1917. There has been a revival of interest in the potential Alaskan oilfields during the year in anticipation of the expected passage of a law providing for the leasing of the Alaskan oil-lands. It is reported to the Geological Survey that investigations of the supposed oil-lands on the Alaskan peninsula were made during the summer of 1918. No legal provision has yet been made for the leasing, and the Alaskan oil-lands are still withdrawn from entry. There was some drilling for oil in the crystalline rocks near Cape Nome in the summer of 1918, but the results were unfavorable, as was to be expected. At Seward some interest was aroused over the discovery of inflammable gas issuing from the mud and water at several localities in the swamps along the railroad. The rocks near these localities, as described in 1915 by U. S. Grant, of the Geological Survey, are slates that have been metamorphosed and folded to a degree which makes it impossible for accumulations of oil or gas to be retained in them.

A Useful Hand-Drilling Device

The accompanying illustration shows the general arrangement of a device that has been found useful for hand-drilling small pieces, enabling the work to be held in an ordinary vise such as is found in any machine-shop. Ordinarily, if a piece to be drilled is held in a vise it is almost impossible to put the necessary pressure on the drill, and it was to overcome this difficulty that the apparatus was designed. By its use any reasonable pressure may be applied easily, and small holes may be drilled rapidly and accurately.

As may be seen from the sketch, the construction is simple. Cut a piece of wood 1 in. thick and about 12 in.



GENERAL ARRANGEMENT OF LEVER AND HAND-DRILL

long, make a slot in the end, and clamp to the tongue of the vise. This forms the fulcrum of the lever. Next cut a piece of wood 30 in. long, ¾ in. thick, and 1½ in. wide, drilling the holes as shown in the sketch and tapering the end to give a convenient grip. This lever is bolted to the drill by a $\frac{5}{16}$-in. cap screw, removing the side handle and fitting the screw into the same hole by which the side handle was held.

In order to use this device, the lever is held in the left hand and the drill is turned with the right. The drill can be forced into the work at great pressure, as well as being held more steady than if drilling unsupported. By slacking the clamp slightly the piece marked *A* can be swung in either direction, so that the drill can remain vertical.

The entire outfit can be made in a few minutes, and will save much time and labor in any small machine-shop not equipped with power-drills.

FROM OUR OWN CORRESPONDENTS IN THE FIELD

ARIZONA

DEVELOPMENT BY HILL TOP METALS MINING CO.—NOVEMBER SMELTER OUTPUT.

HILL TOP.—The Hill Top Metals Mining Co., owning a property in the California mining district, near Paradise, Cochise county, plans during the coming year to build a 200-ton unit to its silver-lead smelter. Effort is being directed toward inducing either the El Paso & Southwestern or the Southern Pacific to build a branch line to the property, according to J. O. Fife, president of the company. Mr. Fife said he had taken the matter of railroad building up with the El Paso & Southwestern, but, while the matter seemed to receive favorable attention, shortage of rails and ties would prevent plans from being carried out in the immediate future. The Hill Top mine has been worked for six years and in a series of tunnels extending through the Chiricahua mountains has opened up big bodies of silver-lead carbonates. Every element of a perfect furnace charge, except coke, exists on the property. Considerable bodies of copper ore also have been opened, but it is proposed to ship this class of ore, making no attempt to smelt it. It has been estimated that there are blocked out and ready to be broken 1,000,000 tons of ore which will average better than $30 per ton. Mr. Fife predicts that when the property is placed on a producing basis it will be in position to maintain normal production for fifty years without interruption. Owing to development by tunneling, the most economical methods of extracting ores by underhand stoping will be possible. Two tunnels extend entirely through Chiricahua range, affording the property an outlet either to the E. P. & S. W. or to the Southern Pacific railroad. The mechanical equipment is excellent. Owing to a cracked cylinder-head in the Diesel engine the property was inoperative for several weeks, but repairs have been made and normal work resumed. R. O. Fife is managing director and mining superintendent. L. D. Huntoon, formerly professor of the geological department of Yale, and Charles Berkey, of Columbia University, have arrived at Hill Top and will be engaged in completing a joint geological survey of the Hill Top Metals Mining Co. and the adjoining Hill Top Extension Mining Co.'s properties. The latter concern, which is owned in Douglas, has developed good orebodies and has an encouraging outlook. John Blumberg is manager.

TUCSON.—W. B. Thompson, who was here recently in course of inspection of his interests in Arizona, sees hope in the copper situation, even though a portion of the stock held at the beginning of 1919 remains unsold. Domestic consumption, he declared, was the greatest in the history of the country. Colonel Thompson visited the Three R mine, recently acquired by the Magma interests, at Patagonia, and expressed the opinion that it had potentialities as a great mine, though much development would be necessary.

PHOENIX.—The sixth annual meeting of the Arizona chapter of the American Mining Congress was held here December 8, with many delegates present to discuss problems of the industry. Officers for the ensuing year were elected. They were: Norman Carmichael of Clifton, re-elected governor; G. M. Colvocoresses, Humboldt, first vice-governor; F. W. MacMennan, Miami, second vice-governor; John C. Greenway, Warren, third vice-governor; H. J. McClung, Phoenix, re-elected treasurer. In the directorate W. F. Boyd of Ray succeeded L. S. Cates, and F. W. MacMennan of Miami succeeded R. Britton Gottsberger.

DOUGLAS.—November smelter output here was not much below that of October. The Copper Queen smelter produced 8,800,000 lb. of copper, but steps have been taken to reduce the December production to 7,500,000. Calumet & Arizona produced 6,338,740 lb. It is known that considerable reduction is planned for December. Tests of equipment of the new transmission line between the Copper Queen smelter and the Warren district have been made. Large transformers and waste-heat boilers, served by the reverberatory furnaces of the plant, have been installed to produce the current for the line. At the C. & A. smelter a peculiar happening has caused a crew of men to be set at work wrecking the upper half of the 300-ft. fume stack at the roaster-plant. In some manner the stack was dented at a point 150 ft. above the bottom. Recently, during the heavy rains which have marked the fall season, moisture collecting at this point formed sulphuric acid which ate through the plate at the dent, and made immediate repairs necessary. The top half is being taken down, section by section, but will be re-built as soon as the damaged plate can be replaced. A temporary stack has been erected to carry off the fumes while work is in progress.

HUMBOLDT.—The Consolidated Arizona Smelting Co. reports that during November the company's Blue Bell and De Soto mines made shipment to the smelter of 12,100 tons of ore. The concentrator handled 8500 tons

of material while the smelter treated 7400 tons of metal-bearing ores and concentrates. The shipments of fine copper bullion to Eastern refineries amounted to 670,000 lb., of which over 500,000 was derived from ores mined on the company's own properties.

CALIFORNIA

NEW OPERATIONS STARTED.

Grass Valley.—A 7-ft. vein containing free gold has been uncovered on the Mulcahy ranch near Newtown and the ranch has been bonded by T. A. Gill and I. E. King of Grass Valley and Lester M. Dull of Pasadena. The bonders have started a shaft and also are engaged in trenching the vein.

Nevada County.—William Buchholz bid in the Black Bear mine in the Rough and Ready district, November 30. The bid, $24,400, covers the judgment, interest, and costs.

Charles and A. J. Kistle purchased the 5-stamp mill at the Black Bear mine and have about completel its erection near the old Lincoln mine on Little Deer creek a short distance east of Nevada City. The mill will be operated by water-power.

John C. Donnelly purchased a roller gravel mill in Plumas county recently and moved it to the Kirkpatrick mine near Forest. The mill has a capacity of 140 tons per day and will be used in addition to the present plant. A quit-claim deed from Warren Delano of Red Hook, New York, to Frank E. Bradley of Derby, Connecticut, to the New Blue Point gravel mine near Smartsville, has been placed upon record. The mine has been famous as a producer and has changed hands many times since it was owned and operated by the late 'Paddy' Campbell. The property is involved in litigation.

Sierra County.—The present workings in the Oro mine near Downieville have been following a 5-ft. vein heavily mineralized and containing free gold. G. P. Reynolds and others of Alameda are operating the property on a bond.

The development work done on the Comet quartz mine near Downieville the past season by the Gold Exploration Co. has been satisfactory. One drift has shown the vein to be 65 ft. wide. This ore contains sulphides and free gold. From present indications the company has pay-ore ready for extraction and treatment. F. O. Richardson is general manager.

Redding.—The Bully Hill Mines Co. at Winthrop has reduced its force from sixty to twenty men. Enough ore being blocked out for fifteen years, it was decided to stop development work until the first unit of the reduction works is in operation. Construction work will be begun in thirty or forty days and the initial unit should be completed in three or four months. Four units are contemplated.

Plumas County.—The Grass Mining Co. has completed preliminary work for extending its 1000-ft. working-tunnel. The mill is to be remodeled and enlarged during the winter months.

COLORADO

CURTAILED PRODUCTION DUE TO COAL SHORTAGE.

Cripple Creek.—The output of the Cripple Creek district for November is estimated at approximately 33,182 tons with a gross bullion value of $292,738. Plants which were down on account of coal shortage are now operating at capacity and the December record, unless another shut-down is found necessary, will be good. The lease of Anderson and Benkelman on the Trail mine of the United Gold Mines Co. expires on January 1. Work is being rushed and in three days of the past week, shipments of ore netted the lessees $8000 after payment of transportation and treatment. The ore shipped was from the bottom or 1400-ft. level of the Dexter shaft, and averaged better than 3 oz. gold per ton. If no renewal is granted, the company will start work on high-grade ore. A dividend of one cent on the 4,000,000 shares of outstanding stock has been declared by the United Gold Mines Co., payable December 20, to stockholders of record on December 10.

Operations have been resumed by the El Paso Extension Corporation and its lessees on the Index mine and Lexington properties on Gold Hill after a shut-down due to coal shortage.

A. E. Carlton, president of the Cresson Consolidated company, in his annual report says: "During the year 94,920 tons of ore were shipped. The net return was $1,039,500, giving the ore a net value of $10.95 per ton. The company received as additional income the sum of $1438 in royalties from 864 tons of ore shipped by lessees, and also $12,208 as interest on deposits, making a total of $1,053,156. The total cost per ton of ore produced was $4.30. Dividends of 10c. per share per month were paid during the year, or a total distribution of $1,464,000; total to date being $8,491,162.

"Development work during the past six months has been almost discontinued on account of labor conditions. This development is essential, for upon the results depends the opening of new high-grade ore and also maintaining our ore-reserves."

Telluride.—Production is very much curtailed, as the Tomboy output has been temporarily stopped, due to changes being made in the milling process. The Smuggler Union Mining Co. has also been making some minor changes in milling operations which have had a like effect. The shortage of railroad cars continues. New generators have been installed at the Bullion tunnel by the Smuggler Union company.

Ophir.—The Ruutilla & Brown Leasing Co. is getting out ore from the Carbonero that carries about 45% lead, in addition to other metals. Mr. Ruutilla has leased the Favorite mine, formerly operated by Andrew Matson, and will develop and ship from this property in addition to operating the Carbonero. The Delta tunnel is to be driven to the Success vein of the Mountain Flower group. Work will be continued during the winter. The construction work at the San Bernardo mine, under lease to the Valley View Leasing Co., is progressing satisfactorily,

although difficulty is being experienced in excavating. The compressor house, blacksmith shop, and transformer house are completed.

Silverton.—The Sunnyside M. & M. Co. is getting under way for a busy season. The rise in lead price offers additional encouragement, and the force of men is being increased from 150 to 300. All the ore-bins are filled, and the mill will be started at an early date. The Iowa Tiger Mining Co. has changed its name to Southwestern Mining Co. All operations are to be confined to the Iowa Gold property, and production from this property will probably be doubled, as the operations on the Mayflower have been abandoned, and the mill will run on Iowa ore exclusively.

Red Mountain.—The Red Mountain Mines Co. con-

ROUND TIMBERS IN A SQUARE-SET STOPE, BUTTE, MONTANA

tinues to run its mill, in addition to making shipments of crude ore. The Mammoth tunnel is reported to be in, a distance of 2250 feet.

Rico.—Work on the Expectation group has been discontinued by the owner, Charles Engle, owing to the depth of the snow. A large body of high-grade copper ore has been opened up, and development will be resumed at an early date next spring.

Paradox Valley.—The Colorado Vanadium Co.'s mill was tried out on November 19, and after a few adjustments the mill operated smoothly. Three shifts are now working.

Ouray.—The Silver City Mining Co. is developing its property with a view to heavy production during the coming season. Construction work is now under way with a force of 25 men, building a boarding and bunkhouse that will accommodate eighty men. A compressor-house, sawmill, and power plant are to be built. A tunnel is to be driven under the old tunnel-site to cut the vein at a greater depth. J. H. White is superintendent.

MICHIGAN

The present year will see the completion of the Calumet & Hecla's great underground haulageway, connecting the South Hecla with the Red Jacket perpendicular shaft. This connection runs through the Calumet amygdaloid vein at a point 180 ft. below the conglomerate. From this main cross-cut is a drift connecting with each of the operating shafts. Ultimate plans for development at extreme depth centre about this work, so that its completion is expected to mark the opening of a new era in the story of the Calumet conglomerate lode.

Mass Consolidated company has suspended mining operations to be resumed only when conditions become normal. The company has been operating at a loss, and the management does not believe the shareholders of the company desire to exhaust the capital resources with unprofitable operations. The company has 1,250,000 lb. of unsold copper on hand.

The general physical condition of the mine never looked better than it does at the present time, practically all of the underground workings being in good copper ore. The Mass management attributes its suspension to the fact that the miners simply will not do a fair day's work.

Victoria produced 108,000 lb. of ingot copper at the rate of 16 lb. per ton in November. Tonnage was 6750. Comparison shows betterment in quality, but falling off in tonnage.

MONTANA

ANACONDA MINES SHUT-DOWN.

Butte.—Owing to the coal strike the mines of the Anaconda Copper Co. have been closed down. Both copper and zinc producers are included, making the most complete shut-down ever seen at Butte. The pumps have been pulled, and the levels below the 2800 of the High Ore mine are filling with water. All water above the 2800 is pumped by electricity at the High Ore pumping plant. Some of the hoisting engineers are being laid off and the engine-room windows and doors are being boarded up, the foreman and watchmen in some instances being the only men retained. While the W. A. Clark zinc and silver mines and the Butte & Superior mine and mills are still working, they may be forced to close at any time. The East Butte company reports about one week's coal supply, and the Davis-Daly's Colorado mine is still operating.

The Hayden-Stone interests have secured an option, or lease and bond on the Otesco group and a large block of surrounding territory. A complete electric surface plant is being erected to sink the Otesco shaft to the 2000-ft. level where exploration will be carried out. A 4-in. air-line has been laid to the Heaney shaft, which is likewise being equipped for a development compaign. This ground is two to three thousand feet south of the Davis-Daly and about the same distance south of the Anaconda company's Belmont mine. The Tuolumne

Copper Co. has picked up the ore-shoot on the 1000-ft. level of the Sinbad shaft by cutting through a local fault. This is presumed to be the downward extension of the orebody which was productive on the 800-ft. level. The stockholders are voting on the bond issue to raise funds with which to sink the shaft from the 1200-ft. to the 2000-ft. level preparatory to further development.

NEVADA

TONOPAH LABOR SITUATION AGAIN NORMAL.—DEVELOPMENT AT DIVIDE.

GOLDFIELD.—Plans of the Development company for enlarging the mill to 2000 tons capacity practically have been completed and as soon as the increase in capitalization of the company has been approved by the stockholders machinery will be purchased. A winze has been sunk 8 ft. on the 12-in. seam opened on the 250-ft. level of the Combination. At 8 ft. the seam assayed $11,000 in gold. A drift driven 68 ft. north in the vein recently opened on the 500-ft. level of the Red Hill has exposed for this distance ore averaging from $18 to $25, with assays of as low as $8.20 and as high as $41 for the width of the drift. Assays of from $16 to $31 were secured in a raise driven 50 ft. from a short south drift which passed out of the ore-shoot. Unimportant assays are now being obtained in the raise, which, while still in quartz, is thought to have been driven through the south-dipping shoot. The raise is being continued and a drift has been started north from a point 50 ft. above the level. A raise also is being driven from the north drift. At a meeting of the board of directors of the Yellow Tiger, held December 8, assessment No. 1, at the rate of 1 cent per share, was levied, the delinquent date being January 10. The officers of the company are Herman E. Clark, of New York, president; A. I. D'Arcy, vice-president and consulting engineer; Gordon M. Bettles, secretary-treasurer and general manager; H. G. McMahon and H. A. Riedel, directors. The number of directors of the Florence company has been increased from 5 to 9 to enabled the transaction of business in New York without holding meetings at Goldfield. The new directors are connected with the Whicher interests.

SILVER PEAK.—The Mary, 10 miles north-east of Silver Peak, is practically closed as the result of a strike of the 15 employees. A compressor is being put in place and it is planned to resume work on a larger scale than before the labor trouble. This is a gold mine, the ore being found in irregular deposits. A number of long tunnels have been driven, but the greatest depth reached is less than 400 ft. Ore from the Nivloc and Mary is treated in a 10-stamp mill at Silver Peak. The Silver Peak Chemical Co. is constructing a 100-ton leaching plant 9 miles north-east of Silver Peak to treat what is said to be the only known deposit of water-soluble potash alum, of commercial size. The deposits are developed through eight shafts of an average depth of 75 ft. and 60,000 tons of material containing 20% potash alum is reported to be blocked out. A report on the deposit was made by J. E. Spurr in the early days of Tonopah and Goldfield and after the War started it was sampled by E. E. Free of the U. S. Geological Survey.

TONOPAH.—Labor conditions in the Tonopah and Divide districts are again normal. During the first week of December a total of 92,710 oz. of bullion valued at $139,565 was shipped from the Belmont, West End, and MacNamara mills. The West End paid a dividend of 5c. per share on December 9, making the total disbursements $1,251,940, or 14% on the outstanding capital stock. The principal work in the West End is being done on the upper levels in the Ohio workings and on the 800-ft. level, where a cross-cut is being driven to cut the Ohio vein. The Belmont mill is treating over 3500 tons of ore weekly, much of which comes from the Tonopah Mining, Butler, Montana, and other mines. The MacNamara mill is treating over 60 tons of ore daily from the Tonopah Divide.

PIONEER.—From July 1 to November 30, 1925 ft. of development work was done in the Mayflower on the 200, 300, 400, and 500-ft. levels. According to a report issued by J. B. Kendall, general manager, containing revised estimates made in the past few days, there is 80,000 tons of ore of an average value of $10 per ton blocked out in a vein 8 ft. wide, with 5000 tons of an average value of $12 stored in the mine. The report places the capacity of the mill at 40 tons daily, based on recent capacity runs, and the extraction is estimated at 80%. Water supply at the Mayflower is a serious problem and it has been necessary to construct a 4000-ft. pipe-line to a spring recently purchased by the company. It will be necessary to develop more water at this spring to permit the mill to operate 24 hours daily, when the profit over all operating expenses in mine and mill will be from $3000 to $5000 per month, according to the report. The company levied a 1c. assessment on December 6, stock to be delinquent in 30 days. Mr. Kendall states that this would have been unnecessary but for trouble in the mill, principally from freezing.

DIVIDE.—The Sutherland, in the northern part of the district, has been closed until the company can be reorganized and additional funds raised through an assessment; 400,000 shares of stock have been sold for 5c. per share and 315,000 remains in the treasury. A 500-ft. shaft has been sunk and over 1000 ft. of lateral work has been done. A drift on the main vein of the district is being driven south-east on the 170-ft. level of the Brougher. A drift on this level is being extended north in a narrow ore-channel supposed to be the extension into Brougher ground of the Divide Extension vein. Assays as high as $60 are being secured at this point. On the 500-ft. level a drift is being continued south-east in 8 in. of sulphide ore from which assays of from $5 to $30 are being secured. At the end of the main north-west drift on this level, 600 ft. from the shaft, a cross-cut is being driven to open a vein, the outcrop of which has been found. The Tonopah Divide has resumed sinking the shaft, which will be continued to water level. On the third level a cross-cut is being driven south-west toward the gold vein, which is expected to be reached with an additional 100 ft. of advance. On this level a drift is being driven north-west in the main vein to prospect the

territory toward the Brougher. On the fourth level a raise has been started in the 'gold shoot' opened several months ago. Assays of 17.2 oz. gold and 10 oz. silver are being secured from a 16-in. width in this raise. Crosscuts are being driven from the south-east drift on the fourth level to prospect the ore into the walls of the silver vein, or again ore channel.

UTAH

LABOR TROUBLES DURING 1919 — SALT SECTION A. I. M. & M. E. MEETS — NOTES.

SALT LAKE CITY.—After more than 30 days, during which Utah has been one of the few States not seriously affected by the strike of bituminous coal miners, the development of shortage elsewhere, resulted in the first material curtailment of distribution in the State on December 5. Simultaneously with the announcement by railroad officials that they had been directed to distribute coal only to essential industries falling within the first five classifications of the Federal priorities list, came the announcement that the plant of the Utah Iron & Steel Co. was compelled to close down for lack of fuel, resulting in several hundred men being thrown out of employment. Mining and smelting companies were listed in sixth class. This resulted in a vigorous protest being sent to the State's representatives in Congress and to Hale Holden, regional director of the U. S. Railroad Administration at Chicago. It was pointed out that the metal mines and smelters of Utah are employing about 22,000 men, and that there were a number of less essential industries that could better afford to close down, considering the general welfare of the State and the number of men that would be thrown out of employment. One of the first metallurgical plants affected by this order was the International smelter at Tooele, which was compelled to draw the fires in several furnaces and lay off a number of employees, temporarily. At present the smelter is running one reverberatory and two blast-furnaces. On December 8, a telegram was received from Mr. Holden, advising that no exceptions would be granted to Utah industries falling within the 'non-essential' classifications. On the same date, local passenger service on the Oregon Short Line, Denver & Rio Grande, and Los Angeles & Salt Lake railroads was curtailed approximately 30%. On December 10 the Union Pacific Railroad Co. issued an embargo against the acceptance of freight of any description, on account of climatic and fuel conditions in Wyoming. It is stated that when the coal mines of Utah are operating at full capacity, their daily output is 370 cars. At present the mines have plenty of cars, but there is a shortage of good miners.

CONCENTRATORS OF UTAH COPPER COMPANY AT GARFIELD, UTAH. ARTHUR PLANT IN THE FOREGROUND. TAILING POND IN BACKGROUND WITH MAGNA PLANT AT EXTREME RIGHT

Labor troubles during 1919 in Utah cost the industries directly affected and the employees on strike a total of more than $900,000, according to information furnished by the State Industrial Commission. Wages lost through strikes in the mining industry averaged $3825 per day for a period of 40 days, making a wage loss of $153,000, while the loss to the industry is estimated at $517,242, making total loss of $670,242. Wages lost through strikes in miscellaneous trades was $2187 per day for a period of 93 days, while the loss to the industries is estimated at $120,900, making a total loss of $324,391. Therefore, the total loss to the State through strikes is approximately $904,633. There has been little unrest in the State, due to the fact that labor leaders here are conservative.

The Utah section of the American Institute of Mining and Metallurgical Engineers held its semi-annual dinner and program at the Hotel Utah on the evening of December 11. Not in years has a more distinguished gathering of engineers been assembled in this city than on that occasion. John P. Gray, the well-known mining attorney of Idaho, acted as toastmaster. Speeches were made by H. V. Winchell, president of the Institute; Waldemar Lindgren, head of the Department of Geology at the Massachusetts Institute of Technology; W. E. Colby, professor of mining law at the University of California; Albert Burch consulting engineer of San Francisco; R. H. Haffenreffer, Jr., president of the Utah-Apex Mining Co.; and R. C. Gemmell, assistant managing director of the Jackling porphyry properties. Among the guests of honor were D. C. Jackling, of San Francisco, and engineers and attorneys from out of the city, who have been here in connection with the Utah Apex-Utah Consolidated lawsuit.

GOLD HILL.—Recent operations at the mine and mill of the Western Utah Copper Co. have been satisfactory, according to Owen F. Brinton, general manager. Sixty-two carloads, aggregating 3100 tons, were shipped during the past month. The mill has been operating steadily, without loss of time. The product of the treatment of the copper-tungsten ore, tungstic acid, is being stored, awaiting market developments. Development work in the upper levels at the mine continues to expose good ore. On the 700-ft. level, the drift along the foot-wall of the vein which has been developed from this level to the surface, has been driven a distance of 100 ft., all in ore.

EUREKA.—A car of silver-lead bullion, probably the highest grade produced at the Tintic mill for some time past, was shipped recently. The car contained 30 tons and was valued at $100,000. Because of the prevailing high price of silver and the excellent grade of the bullion, the value was higher than usual. During the week ending December 6, mines of this district shipped to valley smelters 147 cars of ore, as compared with 150 for the previous week. The Chief Consolidated shipped 34 cars; the Tintic Standard, 27; Iron Blossom, 18; Mammoth, 13; Eagle & Blue Bell, 11; Dragon, 9; Centennial-Eureka, 8; Grand Central, 8; Colorado, 7; Gemini, 5; Ridge and Valley, 2; Victoria, 2; Alaska, 2; and Sunbeam, 1.

Officials of the Lehi Tintic company have outlined a policy for the development of the mine, which lies in the East Tintic district. The mining claims of the company are now being surveyed for patent. The property has been equipped with a 12 by 12-in. compressor, 40-hp. motor, 3 clipper drills, 1 water Leyner drill, an Anaconda air-hoist, and accessories. A 10,000-ft. pipe-line is to be laid by the company to obtain a water supply for the mine. The results of last summer's work in Tunnel No. 3 show conclusively the desirability of staying close to the known orebodies because of their peculiar occurrence in the limestone.

The output of the Ridge & Valley mine has been increased somewhat during the past two months by the heavy shipments from the block of ground under lease to Messrs. Zalinski and Hillsdale, Salt Lake mining men, who have been operating in this district for more than a year.

Plans are being made by the Tintic-Standard Mining Co. to build a 50-ton mill upon its property in the eastern part of the district to handle low-grade ores, according to E. J. Raddatz, general manager. In doing development work considerable low-grade ore has been encountered near the high-grade. None of this low-grade material has been moved, except that necessary to reach the high-grade bodies. For some time the company has been conducting tests to determine the best method of treating this material. If the milling process proves as satisfactory as it has in the laboratory tests, the first 50-ton unit will be increased.

At a meeting of the directors of the Grand Central Mining Co. at the head office in Provo on December 11, a dividend of 2c. per share was declared, payable December 23. This calls for the payment of $12,000.

PARK CITY.—Shipments of ore from local mines for the week ending December 6 show an increase over the previous week, being 2037 tons. Of this amount, the Silver King Coalition shipped 612 tons; the Judge M. & S., 593 tons; the Ontario Silver, 475 tons; the Daly, 54 tons; the Naildriver, 110 tons; and the Daly-West, 190 tons.

Recent development work on the 1100-ft. level of the Silver King Coalition property has opened up a high-grade orebody in a practically virgin part of the company's large estate. A thin streak of mineralization was followed off into a block of unprospected territory. For some distance the streak showed no improvement; then suddenly it spread into 18 in. of ore rich in silver and lead. Samples indicate a market value of around $200 per ton. The lense is still widening, and promises to form one of the large chambers of ore which is characteristic of the western half of this district.

BRITISH COLUMBIA

SALMON RIVER DISTRICT PROMISING.—ORE RECEIPTS AT TRAIL.

STEWART.—The first shipment of ore from the Premier mine is still at Hyder, Alaska, awaiting shipment, according to P. Daly, who took it out under the terms of a lease he had from O. B. Bush in 1915. There is about eight tons assaying around $200 per ton, which he will send to the smelter as soon as transportation is obtained. There is no doubt in the minds of mining men who have visited the various camps in the Salmon River district, as to their future. Without exception they are enthusiastic. M. W. Bruner, who has just returned, describes it as a most remarkable mineral belt and looks forward to seeing a railroad constructed up the Salmon river. Charles F. Caldwell, the well-known British Columbian operator, anticipates much development in the spring, and states that the mine-owners propose solving the transportation problem at once.

NELSON.—In the Kaslo district the Cork Province company has been reorganized in order to raise finances

for further development of large orebodies at depth and to acquire more water power, which is needed for the milling plant. The Silver Bell, Index, Gibson, Flint, and other properties are also under development. All these are new prospects opened within the last eighteen months. The Old Blue Bell, the oldest mine in the country, the Ainsworth, Florence No. 1, and several others have been shipping. The same rate of progress is being made in the Lardo district, where the White Water, Comstock, Bannockburn, Bullock, Silver Cup, Tenderfoot, and other properties are expected to be among next year's shippers.

SLOCAN.—The Silver Glance property, Bear Lake, has been bonded and will be developed quite extensively by the new owners. The vein in granite is a true fissure

TRAMWAY OF THE BRITANNIA MINE, HOWE SOUND, BRITISH COLUMBIA

about 25 ft. wide, striking north and south, and dipping about 60° to the east. Owners of the Index mine have acquired the Flint claim, on which some development has been done with satisfactory results, the consideration being $22,500. A Government mining engineer in 1917 reported that "a nice showing of one foot of solid ore averaging 100 oz. silver and 65% lead" had been opened up.

VANCOUVER.—Maurice D. W. Bacon, of Los Angeles, has filed suit in Spokane against B. K. Neill, of Spokane, for a half interest in the Premier, formerly the Bush mine situated near Stewart, B. C. It is asserted by Mr. Bacon that a partnership existed between him and Mr. Neill; that the value of the Bush mine, as it then was termed, was misrepresented to him, and that Mr. Neill thus obtained possession. Mr. Neill states that there is no foundation for the claim made.

Percy Scott Leggatt, director for Thomas Shotton & Sons, railway owners and car builders of Darlington, England, is quoted as stating that his firm is considering launching an iron and steel industry here, perhaps drawing on the Lillooet limonite ores in the White Water Creek region. His firm is interested in smelters and refineries in England. Mr. Leggatt evidently is satisfied that the ore necessary is available. He seems to be impressed with the possibilities of the electric hearth methods of steel fabrication and, in this connection, declares that the imperative need is to obtain cheap power.

PRINCETON.—The property of the Princeton Mining & Development Co., situated on the Similkameen river about four miles from Princeton, is to be re-opened.

TRAIL.—Ore receipts in gross tons for the week November 21 to 28 inclusive, at the Trail smelter of the Consolidated Mining & Smelting Co. totalled 7708 tons. The chief independent shippers were Alamo, Alamo, 107 tons; Josie, Rossland, B. C., 721 tons; Mandy, Le Pas, Manitoba, 156 tons; North Star, Kimberley, 316 tons; Standard, Silverton, 403 tons. Of the company's properties the main contributors were Centre Star, Rossland, 2907 tons; Emma, Eholt, 479 tons; St. Eugene, Moyie, 1507 tons; Sullivan, Kimberley, 858 tons. It is apparent from the latter figure that the Sullivan mine gradually is recovering from the effects of the recent strike when all its employees walked out.

PRINCE RUPERT.—The Indian group, in the Salmon River district, is developing well, three shoots of milling ore having been cut in a 400-ft. tunnel. A second tunnel has been driven on the vein 150 ft. lower down the mountain, and in its 60 ft. of length has exposed some good ore. The Boundary group, which adjoins the Indian, is under option to the Granby Consolidated M. S. & P. Co. The Hercules Mining Co. claims have been bonded to C. F. Caldwell, and the Lake & O'Leary mine has been taken over by the B. C. Silver Mines, Ltd. The Drum Lummon mine, on Douglas channel, is turning out an excellent grade of copper concentrate; the assay return from the last shipment to the Tacoma smelter ran 62.88% copper, 0.68 oz. in gold, and 27.66 oz. in silver per ton. The Silver Standard mill, at Hazelton, which was closed temporarily on account of the freezing of the water in the supply pipe, is running again. As the pipe is now covered with snow, no further trouble is expected this winter. The Sunrise mine, near Hazelton and about a mile from the Silver Standard, has been bonded to the Guggenheim interests.

ONTARIO

CONIAGAS REPORTS, NOTES.

COBALT.—The reported offer of the Northern Customs Co. to purchase the old La Rose mine has been rejected. The offer was voluntary on the part of the former company, the La Rose not having offered its property for sale. In the annual statement to be issued this week by the Coniagas company, an output of approximately 900,000 oz. of silver will be shown. This compares with

974,000 oz. during the preceding year. The average price of silver was 10c. higher during the fiscal year just closed, so that there will be shown an increase in the value of production. The Mining Corporation of Canada announces its intention to pass the regular dividend for the fourth quarter of 1919, due to loss of time during the recent labor strike. The purchase of a 70% interest in the Buffalo mine, and the purchase of a lease on the Foster mine has also depleted the treasury. The Peterson Lake company is resuming underground operations, and the mill is in readiness for operation at full capacity. Diamond-drilling operations commenced at the 319-ft. level of the Adanac. Other underground work in the meantime has been suspended. The Hargraves and the Reliance properties have been merged and will operate under the name of the Hargraves Consolidated. The company is capitalized at $2,500,000 with 700,000 shares in the treasury. Work is to be started this month. A shipment of high-grade ore will be made during the last half of December from the Castle property at Gowganda, controlled by the Trethewey-Cobalt company. The new shaft has reached a depth of 100 ft. The Reeves-Dobie property at Gowganda is producing silver at the rate of about $1000 per day. No definite information appears to be available regarding the ore in sight or the probabilities of continued output. At the leading gold mines of Porcupine, including the Hollinger, Dome, and McIntyre, the outlook is good. An official statement just made by the Ontario Bureau of Mines asserts that the industry is now almost on a prewar basis, and that some $10,000,000 is the indicated output for Ontario for 1919.

Boston Creek.—Development is being energetically pushed by several companies. At the Miller Independence the delay in securing electrical equipment, which has held work back for some time, has been overcome. The road to the mine has also been completed. A mining plant is being installed at the Peerless and it is hoped to resume underground work about the first of the year. The Ivanhoe-Boston, a new company, has acquired a large group of claims lying to the north-east of the Patricia mine.

West Shining Tree.—The shareholders of the Wasapika Gold Mines at a meeting held on December 2 ratified the plans submitted by the directorate for consolidation with three properties to the north and the formation of a new company capitalized at $6,000,000 to be styled the Wasapika Consolidated. The Wasapika transfers its property to the new company for $3,000,000, each shareholder receiving three shares for one.

Premier Ernest C. Drury, head of the newly founded Ontario administration, accompanied by Hon. Harry Mills, Minister of Mines, is making a tour of the mining districts of Northern Ontario to familiarize himself with the needs of the district. There has latterly been much dissatisfaction among the people of this part of the Province who were of the opinion that the Government was not aiding the opening up of the country sufficiently in consideration of its large contributions to the wealth of the Province, and greater liberality in providing needed public improvements is expected to result from the visit of the new officials.

SONORA

NACOZARI CONSOLIDATED REPORT.—SEVERAL FLOTATION PLANTS TO BE OPERATED.

Buena Vista.—The Louisa Mining Co., a West Virginian corporation, operating the Buena Vista mine in the south end of the Moctezuma mining district, has completed the installation of a 50-ton flotation plant and soon will be shipping its product. Shipments of high-grade ore also will be started in the immediate future, hauling by wagon to Nacozari and from that point by rail to the smelter at El Paso. H. J. Wendler of Los Angeles is the manager.

Progresso.—The Progresso mine has begun shipping its concentrates and precipitates to Douglas, to be sent to the El Paso smelter and the refinery at Perth Amboy, New Jersey, respectively. For several weeks all of the mining properties of the southern part of the Moctezuma district and the northern part of the Sahuaripa district were unable to make shipments or get in supplies owing to the heavy rains which had washed out the roads.

Nacozari Consolidated.—The annual report of the Nacozari Consolidated Copper Co., whose property is situated near the Pilares de Nacozari mines of the Moctezuma Copper Co., has been issued. From February 15 to November 1, 1919, 1540 ft. of driving had been done in the main development tunnel on the Galera group and 600 ft. of driving in the old San Pablo, the company's silver property. Actual mining expenses for the period were $28,684.46, over $8000 of which was spent for other than actual mine work, such as roads, motor-trucks, fuel, oil, and many other necessary items. Several deliveries of high-grade silver ore, returns from which have not been received, will swell the company's receipts soon. Of the company's 1,200,000 shares, 953,288 have been issued and 246,712 remain in the treasury. The breast in the main tunnel shows chalcopyrite and bornite in greater quantities than ever before and the east drift exposes a network of copper seams, indicating proximity to ore.

El Tigre.—This camp was water bound during the greater part of two weeks, roads being washed out and the Bavispe river too high to cross. Operation was maintained at normal level, however, the power-line extending from the Copper Queen smelter at Douglas not being affected by the storms. Quantities of concentrates accumulated, however, and the December shipments of the company should show a heavy increase. An attempt to hold up the stage carrying $15,000 of the company payroll from Esqueda, the company station on the Nacozari railroad, to the mine, 35 miles east, was frustrated December 4, by military guards, one of whom was killed and another wounded. Several arrests have been made and it is predicted by the Mexican authorities that all of the six bandits participating in the attempt will be captured soon.

ARIZONA

Bisbee.—It is reported that an important discovery has been made in the shaft being put down on the Courtland property of the Great Western Mining Co. The ore was found at a depth of 350 ft. and was more than 5 ft. thick. The shaft was sunk where a diamond-drill hole revealed good prospects. The shaft is to be sunk to the 500-ft. level.

Douglas.—It is announced by Gordon R. Campbell, secretary of the Calumet & Arizona Co., that the company will again cut its production to 50% of normal.

Flagstaff.—Work is to be resumed on the property of the Navajo Copper Co., which is situated 125 miles north of Flagstaff. The property has been taken over by a syndicate represented by H. W. Malch of San Francisco. A leaching plant and concentrator are to be erected, and a 20-mile water-pipe line is to be laid.

Jerome.—Changes with the view to increased production at the United Verde Copper Co.'s mine have been made. Firing at the smelter is to be changed from oil fuel to powdered coal, the plant for the latter being practically completed. A Cottrell plant is also to be installed. Three additional 25 by 100-ft. reverberatories, two Great Falls converters, and eight 700-hp. Stirling boilers are being added to the smelter. Six of the last will run on waste heat from the furnaces.

It is reported that the Gadsden Copper Co. is sinking a winze on the 1200-ft. level in soft schist which carries native copper and copper oxide.

Miami.—The Porphyry Consolidated Copper Co. has purchased two No. 27 Star portable drills from the Miami Consolidated Copper Co., and other necessary equipment to carry out extensive exploration. The drills are now on the property. In addition the company has rented a diamond-drill from the Sullivan Machinery Co., to be used on the 650-ft. level.

The Superior & Boston Copper Co. has lately started regular shipments from the orebody recently opened in the foot-wall vein. The extent of the strike has not yet been fully determined.

Prescott.—The Yaba Copper Co. has been organized to operate the old Carrol holdings which parallel the Franco-American property. The Carrol property is a silver-gold producer of earlier days. The Dome group of claims owned by C. B. Hayes has been sold to the Dome Silver Mining Co. for $15,000.

A new reduction plant is to be installed at the Monte Cristo mine on Groom creek as a result of the recent development carried on by W. D. Worthington.

Ray.—It is announced that the White Metal Mining Co., which acquired the Pioneer group of mines a year ago, is to commence shipments. A large tonnage of silver ore has been developed and plans are being completed for the erection of a flotation plant.

Swansea.—This camp is now operating with over 200 men on the payroll. Will L. Clark, formerly with the United Verde, is in charge and it is reported that high-grade ore has been opened on the 600-ft. level. Encouraging results are being obtained from the flotation plant recently installed.

Tucson.—A complete geological investigation of the Stratton mines in the Old Hat district is being made to determine the site of the proposed tunnel. Claims and milling plant of the Emery-Whitcomb Tungsten Co. and the National Tungsten Co. in the Guijas district are to be sold at sheriff's sale as a result of the foreclosure judgment received by J. H. Emery against the two companies.

CALIFORNIA

Angels Camp.—The Lightner mine, an old-time producer and one of the bonanza mines of days gone by, is to be reopened by a company headed by Alex. Chalmers, who was superintendent when the mine was operating before. Work is to be commenced immediately. The shaft will be unwatered and repaired, the head-frame gone over, and the hoisting machinery put in condition.

Downieville.—Gold Exploration Co. is vigorously developing the Comet mine, in Jim Crow canyon, and has completed erection of several buildings. Cross-cuts show the vein is 65 ft. wide with sulphides and some free gold disclosed. A mill and concentrating plant may be installed next year. F. O. Richardson is general manager.

Engelmine.—Engels Copper Mining Co. has improved and remodeled the Superior mill and is shipping 50 tons of concentrate daily. Alterations and additions to the mill were under the direction of F. G. Sherwood, consulting engineer. ——Feather River Copper Co. has installed a two-stage, 300-cu. ft. Sullivan compressor, drills, and other equipment. Driving of the main tunnel, 2500 to 3000 ft. long, has begun.

Kennett.—Afterthought Copper Co. is treating 250 tons of ore daily in its flotation plant. The reverberatory furnace is making a matte running 25 to 28% copper; 110 men are on the payroll.——Uncle Sam Mining Co. has started development under Mr. Charlson, superintendent. It is planned to run a cross-cut from the Uncle Sam shaft to prospect the Alice, Clipper, Snyder, Croesus, and Dittmar-Monohan claims.——Mammoth Copper Co. is increasing development work and opening new ground.

Keswick.—Mountain Copper Co. has added a night shift to the force at Hornet mine. Shipments of sulphide ore to the Martinez smelter have been increased.

IDAHO

Bonner County.—The Lakeview Silver Mines Co., operating the Conjecture and Spider mines at Lakeview, is preparing for the installation of a 100-ton flotation mill early in the spring. Hdyro-electric power will be developed and transmitted a distance of about three miles to the mine, where hoisting and shaft equipment is to be remodeled and a compressor installed. Development work has been in progress during the past six months, and a large tonnage of ore is already blocked out for the mill. T. C. Cunningham is superintendent.

Clarksfork.—The Lawrence Mining & Milling Co is in receipt of $2526 in net payment for a carload of lead-silver concentrates shipped to the East Helena smelter. This increases the total net receipts to $55,500. The ore in the last lot contained an average of 14 oz. of silver and 75% lead, or a total of $77 per ton.

The main tunnel, driven 1240 ft. from its portal, has just

passed through a porphyry dike 15 ft. wide, one-third of which on the hanging-wall side is mineralized with copper. Joseph Reed is manager.

Coeur d'Alene.—John A. Shelton, attorney of Butte, has secured an option on the control of shares in the Black Bear Mining Co. owning a property in the Lelande district.

The Tamarack & Custer Consolidated Mining Co. has declared a dividend of $56,400, being at the rate of 3c. per share. This dividend is the first declared by the company in 14 months, and when paid will increase the total disbursements to $446,992.

The Hypotheek mine has resumed work according to information from Otto A. Olson, secretary and manager at Wallace. This property is situated about three miles south of Kingston and over the divide west of the Pine Creek district.

Hailey.—The Federal Mining & Smelting Co. is completing a tunnel that will connect its Independence and North Star mines, near Hailey. The bore lacks about 400 ft. of completion. It penetrates a mountain and will permit the rapid delivery of ore from the Independence mine to the North Star mill.

Wallace.—The following notice has been sent by the Hecla Mining Co. to its stockholders:

"In reply to inquiries as to threatened litigation we wish to advise you that on November 22, 1919, we were served with notice of suit filed by Federal Mining & Smelting Co. alleging that we have mined and taken out ores belonging to them by virtue of apexing in the Russell lode mining claim. This claim is owned by the Federal and is under lease by them to the Marsh Mines Consolidated. Our answer to their complaint will be made only in court at the proper time. We may state, however, that the ore involved is only what is known as our East orebody and cannot affect the main orebody nor the Ore-or-No-Go, and that all ore mined by us has been taken from within our own lines. There is a great deal of misinformation being published on this subject, exaggerating the amounts involved and the probable effect on dividends.

"You are hereby notified that a dividend of 15 cents per share will be paid on December 28, 1919, to stockholders of record at the close of business on December 1, 1919."

MONTANA

Butte.—The North Butte company has recently re-opened the Edith May vein on the 3200-ft. level where it has a 20-ft. face of 6% copper ore. The company is now capable of a sustained production of 2,000,000 lb. of copper per month, and with high silver prices and increased mine efficiency the management has been able to effect a remarkable reduction in costs. In November its cost was below 13c. per pound and it has been a very long time since North Butte costs were anything like that.

Helena.—The Liverpool mine, the old silver property in the Lump Gulch mining district, which is being re-opened by the Liverpool Silver Mines Co., under the management of Eichelberger and Fryberger of Helena, has been unwatered to the 750-ft. level. At the 600-ft. level a considerable quantity of rich silver ore, left by previous operators, was found.

NEVADA

Denio.—Ashdown Mining Co. is erecting a 60-ton mill. Property has been developed by ten tunnels, with No. 10 level showing an orebody 3 to 7 ft. wide. All levels are said to be in good silver and gold ore. T. S. O'Brien is general manager.

Midas.—Arrangements have been made to sink the 225-ft. shaft of the Gold Circle Queen 100 ft. deeper. On the bottom level of the shaft the vein is 18 in. wide, assaying $75 in gold. A test run is being made at the Koontz mill. R. S. Bolam is superintendent.

Personal

The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

John B. Farish has returned from New York.

J. W. Teale, of Bainbridge, Seymour & Co., is in Brazil.

Malcolm Maclaren has returned from Rumania to London.

Clarence Woods has returned from Honduras to Los Angeles.

Tudor G. Trevor, Inspector of Mines in the Transvaal, is in London.

W. L. Honnold has gone to London, on his return to South Africa.

Oscar H. Hershey, on his return from Colorado, has gone to Oatman, Arizona.

H. V. Seale is now manager of the Junction North mine at Broken Hill, Australia.

Charles A. Banks is now established as consulting engineer at Vancouver, B. C.

E. J. Franklin, mechanical engineer for the Ray Consolidated Copper Co., is at Salt Lake City.

Ralph Stokes, Colonel and Chief Engineer of the British force on the Archangel front, has returned to London.

J. F. McCarthy, of Wallace, Idaho, has been nominated as chairman of the Columbia Section of the A. I. M. E. at Spokane.

William B. Daniel, general superintendent for the Nicaragua Mining Co., sailed from New Orleans on the 'Managua' for Bluefields on December 8.

S. E. Bretherton, Jr., who recently returned from an engagement on the technical staff of the Burma Mines Co., is now at Atascadero, California.

C. B. Lakenan, general manager for the Nevada Consolidated Copper Co., at McGill, Nevada, was at Salt Lake City recently, conferring with **D. C. Jackling**.

Frank Yeoman, of Oroville, California, and **W. W. Wishon**, of Searchlight, Nevada, have just returned from a detailed examination of the Cariboo district in British Columbia.

Joseph T. Singewald, Jr., professor of economic geology in Johns Hopkins University, has been granted several months leave of absence to engage in geologic work in north-western Peru.

R. F. Goodwin, assistant consulting engineer for the Guggenheim brothers and the Chile and Braden copper companies, was in Utah recently, on his way from British Columbia to New York.

Obituary

Benjamin Hollinger, discoverer of the Hollinger mine of Porcupine, Canada, died at Pembroke, Ontario, on November 26 at the age of 34 years. He took to prospecting when quite young, but had no marked success for some years, when the discovery of the celebrated Hollinger mine placed him in a position of affluence. He also discovered the Hollinger Reserve and was interested in a number of other mines. He leaves a widow and three children.

J. W. Moffatt, formerly manager of the Beaver and Temiskaming mines, at Cobalt, and a pioneer of Northern Ontario, died at Haileybury on November 27 of tuberculosis. He came to Canada about 14 years ago from Colorado, and engaged in mining. He built several mills, including those at the Penn Canadian, Silver Cliff, Beaver, and Kirkland Lake mines, and, until forced to retire owing to ill-health, was in charge of the Beaver and Temiskaming mines. He leaves a widow and one child. He was interred at Toronto on November 29 with Masonic ceremonies.

THE METAL MARKET

METAL PRICES

San Francisco, December 9

Aluminum dust, cents per pound	65
Antimony, cents per pound	10.00
Copper electrolytic, cents per pound	18.75
Lead pig, cents per pound	7.25–8.25
Platinum pure, per ounce	$150
Platinum 10% iridium, per ounce	$180
Quicksilver, per flask of 75 lb	$100
Spelter, cents per pound	10.00
Zinc dust, cents per pound	12.50–15.00

EASTERN METAL MARKET

(By wire from New York)

December 16.—Copper is quiet and firm. Lead is quiet and stronger. Zinc is dull and easy.

SILVER

Below are given official or ticker quotations in cents per ounce of silver 999 fine. From April 23, 1918, the United States government paid $1 per ounce for all silver purchased by it, fixing a maximum of $1.01½ on August 15, 1918, and will continue to pay $1 until the quantity specified under the Act is purchased, probably extending over several years. On May 5, 1919, all restrictions on the metal were removed, resulting in fluctuations. During the restricted period, the British government fixed the maximum price five times, the last being on March 25, 1919, on account of the low rate of sterling exchange, but removed all restrictions on May 10. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the normal rate of exchange.

Date	New York, cents	London, pence
Dec. 10	131.00	75.25
" 11	130.50	76.25
" 12	130.50	78.25
" 13	131.25	78.25
" 14 Sunday		
" 15	131.50	78.87
" 16	133.00	

Average week ending	Cents	Pence
Nov. 4	122.20	66.16
" 11	124.32	67.22
" 18	125.73	68.81
" 25	131.93	73.46
Dec. 2	132.00	73.50
" 9	131.29	74.75
" 16	131.29	77.38

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan	75.14	88.72	101.12	July	78.92	99.62	106.36
Feb	77.54	85.79	101.12	Aug	85.40	100.31	111.35
Mch	74.13	88.11	101.12	Sept.	100.73	101.12	113.92
Apr	72.51	95.35	101.12	Oct.	87.38	101.12	119.10
May	74.61	99.50	107.23	Nov	85.97	101.12	127.57
June	76.44	99.50	110.50	Dec	85.97	101.12	...

COPPER

Prices of electrolytic in New York, in cents per pound.

Date		Average week ending	
Dec. 10	18.50	Nov. 4	21.37
" 11	18.50	" 11	21.10
" 12	18.50	" 18	21.36
" 13	18.50	" 25	19.48
" 14 Sunday		Dec. 2	18.55
" 15	18.50	" 9	18.21
" 16	18.50	" 16	18.50

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan	29.53	23.50	20.43	July	29.67	26.00	20.82
Feb	34.57	23.50	17.34	Aug	27.42	26.00	22.51
Mch	36.00	23.50	15.05	Sept.	25.11	26.00	22.10
Apr	33.16	23.50	15.23	Oct.	23.50	26.00	21.66
May	31.69	23.50	15.91	Nov.	23.50	26.00	20.45
June	32.57	23.50	17.53	Dec.	23.50	26.00	....

LEAD

Lead is quoted in cents per pound, New York delivery.

Date		Average week ending	
Dec. 10	6.90	Nov. 4	6.75
" 11	6.95	" 11	6.75
" 12	6.95	" 18	6.80
" 13	7.00	" 25	6.75
" 14 Sunday		Dec. 2	6.75
" 15	7.05	" 9	6.82
" 16	7.10	" 16	6.99

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan	7.64	6.85	5.60	July	10.93	8.03	5.53
Feb.	9.10	7.07	5.13	Aug.	10.75	8.05	5.78
Mch.	10.07	7.26	5.24	Sept.	9.07	8.05	6.02
Apr.	9.38	6.99	5.05	Oct.	6.97	8.05	6.40
May	10.29	6.88	5.04	Nov.	6.38	8.05	6.76
June	11.74	7.59	5.32	Dec.	6.49	6.90	....

TIN

Prices in New York, in cents per pound:

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	44.10	85.13	71.50	July	62.60	93.00	70.11
Feb.	51.47	85.00	72.44	Aug.	62.53	91.33	62.20
Mch.	54.27	85.00	72.50	Sept.	61.54	80.40	55.79
Apr.	55.63	88.53	72.50	Oct.	62.24	78.82	54.82
May	63.21	100.01	72.50	Nov.	74.18	73.67	54.17
June	61.93	91.00	71.83	Dec.	85.00	71.52	....

ZINC

Zinc is quoted as spelter, standard Western brands, New York delivery, in cents per pound:

Date		Average week ending	
Dec. 10	8.72	Nov. 4	7.97
" 11	8.80	" 11	7.97
" 12	8.70	" 18	8.28
" 13	8.65	" 25	8.16
" 14 Sunday		Dec. 2	8.31
" 15	8.60	" 9	8.58
" 16	8.55	" 16	8.65

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	9.75	7.78	7.44	July	8.98	8.78	7.78
Feb.	10.45	7.97	6.71	Aug.	8.58	8.78	7.81
Mch.	10.78	7.67	6.53	Sept.	8.63	9.58	7.57
Apr.	10.20	7.04	6.49	Oct.	8.32	9.11	7.82
May	9.41	7.92	6.43	Nov.	7.76	8.75	8.12
June	9.63	7.92	6.91	Dec.	7.84	8.49	

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market, according to quantity. Prices, in dollars per flask of 75 pounds:

Date	
Nov. 18	80.00
" 25	75.00
Dec. 2	95.00
" 9	100.00
" 16	100.00

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	81.00	128.00	103.75	July	102.00	120.00	100.00
Feb.	126.25	118.00	90.00	Aug.	115.00	120.00	103.00
Mch.	113.75	112.00	72.80	Sept.	112.00	120.00	102.00
Apr.	114.50	115.00	73.12	Oct.	102.00	120.00	86.00
May	104.00	110.00	84.80	Nov.	102.50	120.00	78.00
June	85.00	112.00	94.40	Dec.	117.42	115.00	....

MONEY AND EXCHANGE

When the Edge bill becomes law there will be two measures provided for financing export trade having Government approval. The other measure is the amendment to the War Finance Corporation Act authorizing that institution to extend loans up to $1 000 000 000 "to promote commerce with foreign nations through extension of credits." Both measures are distinct and while they operate with the same purpose the administration and extension of credits are different.

The Edge bill provides for incorporation, under Federal charter, of private financial institutions, such as are not now operated, of two classes—one doing principally a banking business, like that done by international banking corporations already organized, and the other doing principally an investment business, taking long-time paper, including bonds and mortgages of foreign concerns, and subsequently issuing their own debentures against them.

There are eight organized international banking corporations helping finance foreign trade. These are American International Banking Corporation, Asia Banking Corporation, First National Banking Corporation, French-American Banking Corporation, International Banking Corporation, Mercantile Bank of the Americas, Park-Union Banking Corporation, and the Shawmut Corporation.

To facilitate flotation of proposed corporations under the Edge bill and provide necessary financial support from established banks, Congress has already legislated to permit national banks to invest up to 5% of their capital in such corporations. Authority of the War Finance Corporation to extend loans for commerce purposes has not so far been exercised. Explaining inactivity in this respect, the Secretary of the Treasury says in his annual report: "During the first few months after passage of the amendment, loans by the Treasury to foreign governments, authorization of the War Department to sell its surplus stock on credit, authority of the Food Administration to sell on credit, and special measures passed by Congress for relief of European nations, sufficed to maintain an exceptionally high level of exports, but the time has now arrived when this new authority conferred upon the War Finance Corporation is beginning to be used in the way contemplated."

The corporation is authorized to extend loans to persons and firms engaged in export trade, if such concerns are unable to obtain funds upon reasonable terms from banks. It may also loan to banks direct which have made loans to persons for exporting products. Loans may be made for not exceeding five years, and power for making loans is granted to the Corporation until expiration of one year after termination of the War as proclaimed by the President.

The War Finance Corporation holds large amounts of Liberty bonds as well as Treasury certificates. Liquidation of Treasury certificates at maturity and sale of a large part of holdings of bonds to the Treasury for its bond purchase fund, will enable the corporation to liquidate its bonded indebtedness, due April 1, 1920, and provide a considerable surplus of available funds. Stimulation of export trade, not only with European countries, but with South America and the Orient, will be the obvious result.

Quotations on December 16 are as follows:

Sterling:	Cable	3.77
	Demand	3.76
Francs:	Cable	10.25
	Demand	10.20
Lire:	Demand	12.90
Marks		2.25

Eastern Metal Market

New York, December 10.

The [illegible] nature of all the markets, particularly in London, is a feature. Advances have been recorded here in most metals.

Copper is higher and it is believed the low price has been reached.

The tin market has been quiet with prices steady and sales moderate.

Lead is strong and higher and supplies are scarcer.

Prices for zinc have advanced again due to the export demand and speculation in London.

Antimony is nominally higher.

IRON AND STEEL

A much more serious shortage confronts the iron and steel trade than that which has been a matter of concern for weeks. Restrictions in the use of fuel are likely to be in force for weeks, no matter if the Indianapolis meeting results in a settlement. Beehive coke-ovens are limited to 50% of the coal charged into them in November and by-product ovens are put on 30-hr. coking time, thus cutting their output by 50%. A 10-day enforcement of this order would result in a shut-down of nearly half the blast-furnaces of the country. A sharp flurry in the coke market last week resulted in an order from Washington restoring the war-time prices of $6 at oven for blast-furnace coke and $7 for foundry coke. Thus far iron and steel producing plants seem to have been hurt more than those of consumers. In the Pittsburgh district sheet and tin-plate operations are much restricted. Pig-iron prices continue to advance rapidly. Steel makers are less inclined to accept new business and the Steel Corporation maintains its policy of holding at the March 21 schedule of prices. Export orders booked in November do not bear out the report that American steel makers had withdrawn from the market.

COPPER

The market has taken a turn for the better. Electrolytic copper sold as low as 18c. a few days ago, but there has been a gradual advance since then until today the level seems to be 18.50c., New York, for early delivery and in some cases January shipment also. Lake copper is held at about 19c., New York, although last week it sold at the same level as electrolytic. These are the prevailing quotations of leading producers, and it is understood a good business has been booked with regular customers. Smaller interests are in a few cases quoting under this level, but 18.50c. seems a fair appraisal of the general market. There is a moderately active speculative market, which exhibits some unusual features. Speculators and dealers are bidding actively for the metal, and are paying as high as 19 to 19.50c. for electrolytic. There is also activity in copper speculation in London, which is having some effect here. Some believe that the low level was reached here last week at 18c. and a more confident tone is discernible. The copper stocks are also stronger in Wall Street.

TIN

The week has been a quiet one. Consumers have bought lightly because of the coal strike. The predominant influence, however, has been the fluctuations in sterling exchange. The decline on this first frightened sellers and then the buyers, and any advance in London was ignored. In that market speculation has been rife, and on Monday, December 8, tin advanced over £5 per ton. This would ordinarily mean an advance here of 1c. per pound, but the rise was only ½c. Spot Straits, which had declined to 53.50c., was yesterday quoted at 54c. All favorable news has been offset by the exchange situation. Future shipment, December-January, from the Far East has been quoted at 54.25c. with no buyers. One estimate is that the buying last week has been under rather than over 500 tons. Spot Straits in London yesterday was quoted at £308 10s. Arrivals thus far in December have been 1765 tons, of which 640 tons is credited to Pacific ports. The quantity afloat is 5890 tons.

LEAD

Curtailed production, which has been referred to before and which has been evident for some time, is now being felt in several directions; at least it is more noticeable. Some of the independent sellers are in a bad way, for they have not got the metal. Those who did have it have made good sales recently, as has also the leading interest. It is estimated that the tonnage for the week has been fairly large. The American Smelting & Refining Co. has been the cheapest seller, but in the outside market premiums of $2 to $5 have been asked and realized on some brands. Last Friday, December 5, the leading interest advanced its quotation from 6.75c. to 6.90c., New York, and from 6.50c. to 6.65c., St. Louis. The tone of the market is strong and the tendency upward. Outside of the United States lead supplies are also more limited. Supplies from Australia and Spain have been interfered with and the British government is still holding its stocks.

ZINC

The market is largely controlled by the London situation, where speculation seems to be a dominating factor. Advances have been recorded over there almost daily, and they have been reflected in this market. Yesterday prime Western for December and first quarter shipments sold for export at 8.37½c., St. Louis, or 8.72½c., New York, which we quote as the market. Domestic demand is very light. The strength of the market is also due to the lack of eagerness by large producers to sell. The coal situation is an uncertain factor also, so far as it may influence future output of metal. Export demand is excellent but the exchange situation is a deterrent factor. The price of zinc in London advanced £1 12s.6d. per ton on December 8 to £53 7s.6d. for spot and £53 17s.6d. for futures.

ANTIMONY

The market is strong and nominal at 9.50c., duty paid, New York, for wholesale lots for early delivery.

ALUMINUM

Wholesale lots of virgin metal, 98 to 99% pure, are unchanged at 32 to 33c., New York, for early delivery.

ORES

Tungsten: The market is devoid of feature and is quiet. Quotations are nominal at $7 to $15 per unit, depending on the grade, Chinese being the lowest. The Tool Steel Association has come out against the tariff on tungsten and there is very little chance of any action on this for some weeks, since Congress has too many important matters on hand. Ferro-tungsten is nominal at $1 to $1.15 per pound of contained tungsten, according to one authority, but the market has had no definite test lately.

Molybdenum: The market is dull with quotations nominal at 75c. per pound of MoS_2 in 90% concentrates.

Manganese: No transactions in high-grade ore are reported, and quotations are nominal around 50c. per unit. Importations in October were 15,863 tons against 48,917 tons for the same month in 1918. The total to November 1, 1919, is 285,274 tons against 431,299 tons to November 1, 1918.

PRODUCTION of gold in Australia continues to decrease, for the first half of 1919 the total was 667,398 ounces, as against 750,249 ounces in the corresponding period of last year. Production elsewhere in the world is decreasing, slightly in South Africa, more pronouncedly in Rhodesia, West Africa, and India.

GOLD from South Africa is selling in London at a premium of 20%. This means a handsome increase of profit to the mines of the Rand. For example, to the Crown Mines company the premium means a gain of £49,000 per month. It will, of course, bring large tonnages of banket within the category of 'ore' and add considerably to the life of the mines. Financiers expect the premium to continue for several years. It is logical.

WE are informed that Mr. Horace Pomeroy, of Palo Alto, California, has been appointed the third member of the War Minerals Relief Commission, to fill the vacancy created by the death of Dr. Foster. Mr. Pomeroy is an experienced mining engineer and ought to prove a welcome co-worker with Mr. Philip N. Moore, on whom so much of the work of the Commission, owing to sundry circumstances, has developed. Mr. W. R. Crane, who has been acting as chief engineer to the Commission since the retirement of Mr. J. E. Spurr, has been appointed his official successor.

CONDITIONS in Russia are suggested by the following items from letters received recently from mining engineers. In the Don coal region, there is a general lack of food, because General Denikine has failed to consolidate the country behind his advance, so that the people see no improvement of affairs and regard his rule as but slightly better than that of the Bolsheviks. It is true they are no longer tortured or killed, but food and clothing are as scarce as ever. In the anthracite district the peasants have no flour-mills, so the manager has rigged up a mill out of the machinery available and he is now grinding the wheat, taking a pood of flour for every pood he returns; in this way he has been enabled to raise the bread ration to two loaves per day, instead of one, but as regards supplies of clothing he is in despair, the people being clothed in nothing but sacking made out of old bags found at the mines. Even this source of supply is exhausted, so that the outlook for winter is terrible. From the Spassky copper mine, in Siberia, comes the belated report that Kolchak likewise was unable to consolidate the country behind him and this fact weakened his position greatly. The peasants have no more love for him than they have for the Bolsheviks, because he has not bettered their plight; they see only that their young men are conscripted and it is always fight, fight, fight. They are sick to the heart of the unending confusion and conflict.

IN the current bulletin of the Institute we find a page devoted to simplified spelling and the propaganda of "a small group of members of the Institute headed by W. H. Shockley". It appears that these gentlemen insist that the use of the so-called simplified spelling be submitted to the members for a ballot by letter. The Secretary quotes a couple of paragraphs from Mr. Shockley's correspondence to illustrate the horrors he wishes so intensely to inflict upon us. Members are warned that this is no joke but a serious propaganda forced upon the Institute under Section 4 of Article IV of the constitution, whereby any matter that is advocated by 25 members must be put to vote. We hope therefore that all our fellow members will take the matter seriously and get rid of it by an overwhelming vote in favor of protecting our language against the vagaries of cranks. Mr. Shockley is a friend of many of us and a man held in high regard for everything except his irritating persistence in this regard. We say "irritating" because, without any authorization, he took upon himself to use his weird style of spelling in writing the notices that he issues as secretary of the local section of the Institute. It was only the fact that he was a most efficient secretary and a man held in general esteem that prevented trouble over this trespass on the good nature of the local members of the Institute. If the spelling of the 'Bad Boy's Diary' is to be established, it will be necessary to re-print every book in the English language. The publications of the Institute are for men, not for children; nor are they meant as a field for the exercise of the orthographic eccentricities of any group of members.

LONDON continues to show interest in mining, despite the fall in sterling exchange. The impetus to a resuscitation of activity is due, in part, to the fact that the Government has lifted the Treasury restrictions on the raising of fresh funds for companies operating abroad. We note that the group of mining companies working in Siberia and associated with the financial initiative of Mr.

Leslie Urquhart are to be consolidated in a corporation having a capital of £12,000,000. The companies included in the projected amalgamation are the Irtysh, Kyshtim, Tanalyk and Russo-Canadian. Of the total share capital, two-thirds is to be issued at once in exchange for the capitals of the existing companies, if the scheme is confirmed by the approval of their shareholders duly assembled. To holders of shares in the first three companies it is proposed to give two new shares for each share now held, whereas the Russo-Canadian Corporation's capital of three million $5 shares is to be exchanged for 1,703,152 shares in the consolidation. Outstanding debentures will be exchanged for debentures of the new corporation, which will also provide shares for debenture-conversion rights and options. These rights, if exercised, will call for 1,171,379 shares altogether, making the total issued capital £9,628,351, so that 2,371,649 shares will be left for future needs. At present no issue of shares for cash is contemplated. The scheme is bound to be criticized by the shareholders of the constituent companies and it is unlikely that everybody will be pleased. The circumstances of the companies, as to finances and as to ore-reserves, differ widely. The proposal suggests an optimistic view of Russian affairs and a cheerful anticipation of the supercession of the existing political and economic chaos by stable government. The consolidation will strengthen the general position of these companies, but again brings forward the question whether it is not easier to make super-enterprises than to find the supermen to direct them. When they were started these companies had the personal attention of several able men, notably Messrs. Urquhart, Herbert Hoover, and R. Gilman Brown. Of these, Mr. Hoover has retired from participation in the management, but there remain Mr. Urquhart, who understands Russia and the Russians as few Englishmen or Americans do, and Mr. Gilman Brown, who has shown himself both an expert technician and an able adviser. The Russian managers at the mines have proved capable and loyal. A suitable organization should be forthcoming. However, the story of the big consolidations on the Rand and elsewhere has indicated how difficult it is to retain the personal touch, which makes management efficient, when an enterprise becomes too large for the close supervision of a man of high character and unusual ability.

SUNDAY supplements are too voluminous to maintain a high quality, even when forming part of such a newspaper as the 'New York Times'. In the last Sunday issue to reach us we read an account of the South African diamond industry that is full of ignorance of a subject concerning which any quantity of accurate information is readily available, for example, in the well known volumes by Mr. Gardner F. Williams. The writer of the rubbish in 'The Times' says that Alfred Beit was "worried to an early grave by thousands of match-making mothers", from which one might infer that he died young. "So great did the pest become that Sir Alfred made public announcement through his physicians that he was in no physical condition to marry." A fabrication; moreover, Beit was never knighted. Next we are told: "Rhodes needed expert help, and he sent to America for it in the person of John Hays Hammond, who revolutionized diamond mining, and subsequently developed the gold mines at Johannesburg." Fiction. Mr. Hammond has not known, nor has he claimed to know, anything about diamond mining, nor had he anything to do with the mines at Kimberley. The American engineer, who was engaged through the Rothschilds, was Mr. Williams, as every member of the profession is aware. Another gratuitous item of misinformation is the statement that the diamonds of South Africa "are invariably found in the craters of extinct volcanoes". They are indeed found in the choked vents through which igneous matter has been forced, but not "in craters". A crater is the bowl-shaped cavity made by violent plutonic action; the writer of the article was misled by the fact that the mines at Kimberley were worked in a big open-cut of crater-like form; it was man, not nature, that made the crater now familiar through the photographs of the De Beers mine. In short, the author of the article made as many foolish blunders as was possible in the space at his command, and yet he signs himself "former editor of the Johannesburg 'Daily News' ". Our esteemed contemporary has been hoodwinked.

IF any doubt exists as to the present decline in gold mining, it should be dispelled by a study of the statistics and graphs prepared by Mr. H. N. Lawrie and published by the American Mining Congress. Most of the data appeared in an article by Mr. Lawrie published in our issue of October 26, 1918, but we are glad to see the subject further ventilated. The figures of production and consumption are from Geological Survey and Mint records, the estimates for 1919 being based on actual statistics covering the first ten months of the year. Since the peak was reached in 1915, the value of the gold produced in this country has steadily declined from $98,000,000 to $55,000,000, a decrease of 44%. Two-thirds of the output during the decade 1908 to 1917 was from silicious ores, and one-fourth from placer operations, while the remainder was derived as a by-product from base-metal mines. This last source is comparatively small, it fluctuates very little, and does not greatly influence the total production. Obviously this remarkable decrease in production is the best possible evidence, if any be needed, for substantiating the assertion that many productive gold mines have been compelled to discontinue operations by reason of adverse economic conditions. Certain individual producers doubtless have exhausted their ore-reserves, but under favorable circumstances the usual proportion of exploratory and developmental work would have made new mines, and new ore in old mines, available, to an extent more than sufficient to offset ordinary depletion. Moreover, while wages and the prices of commodities remain where they are, these difficulties will be aggravated rather than improved, and further decline in production will necessarily follow. On

the other hand, data on the consumption of gold for the manufacture of jewelry and other industries during 1919 reveal an increase since 1908, from $31,000,000 to $65,000,000, or slightly more than double. Reverting to the figures of production, it appears that for the current year manufacturers will use $10,000,000 worth of gold, over and above the output of the mines; and that the annual monetary surplus, which from 1908 to 1916 ranged between $45,000,000 and $60,000,000, will have been converted into a deficit. At the same time the gold reserve of the country is being depleted, as a result of the removal of the embargo on gold exportation; a net loss of 6.1% in the stock of monetary gold being recorded for the three months' period from July to October. Rather than allow the monetary reserve to decline too far, the industrial consumption will necessarily be limited by Federal authority, to accord with the amount of gold newly produced, so that jewelers and other manufacturers will be the first to suffer from the continued decrease of output, which must certainly result if no action is taken to assist the producers.

Apex Suits

One legal battle arising from dispute over extra-lateral rights to orebodies has been concluded recently in Montana; another is progressing laboriously in Utah; and rumblings of a third come from Idaho. The cost of these performances is large, and out of proportion to their public value. The Bingham case has been in court for a hundred days at an aggregate cost, to both sides, it is reported, of $2500 per day. This represents only a small part of the total expense incurred, for, apart from the retainer paid to attorneys and expert witnesses, it is necessary to do a large amount of work in the mines for the purpose of proving or disproving the points in controversy. To do this it is customary to drive cross-cuts, drifts, and raises at various points in both mines, in order to throw light on the lode-structure. Occasionally, as in the old litigations at Butte, such work leads to the finding of new orebodies, but usually it has no economic value. Even the scientific evidence that it may furnish is obscured by the need for using it for partisan, and essentially unscientific, purposes. The total cost of presenting the Bingham suit, including work in the mines, models, witnesses, and attorneys, is estimated at $250,000 for each side. The recurrent spectacle of half a dozen first-rate men, often university professors of distinction and scientists of high repute, testifying that something is black, while an equal number of equally able and honorable men swear that it is white, is both a public scandal and a satire upon our juridical system. Usually the evidence would justify a conscientious and competent observer in giving a qualified and hesitating testimony, which may be termed 'gray' in distinction to the positive 'black' and 'white' of the opposing array of so-called experts. They, of course, play the part not of scientific witnesses, but of special advocates, using their geologic training to best each other and thereby either to aid the trespass of one mining company upon another or to help one of them in repelling the invasion of his territory. Obviously the engagement of expert witnesses should devolve upon the court, not upon the litigants, who, however, should share the cost involved. This would be economical, because three men of established character, as truthful and accurate observers, would suffice to take the place of the dozen or more men now engaged by the two sides. Two of them might be chosen by the two sides and the other by the judge. The occupation—for that it is to some—of 'experting' in mining litigations would then become one of dignity and honor; moreover, the geologic findings would have a scientific value that cannot be accorded today to the biased explanations that are heard in court. This suggestion is not new, but the Bingham case renders timely a serious consideration of it, in the interest of the geological profession, as well as of the mining industry.

The New Evangel

The week between Christmas and the New Year is a period that prompts the memory and the imagination, bringing to mind old friends and awakening hopes of the future. For while, at least, we are in a 'giving' mood, our selfishness is softened, our sympathy is warmed; we feel the promptings of the message that the angels brought to the shepherds of Bethlehem. Our own Christmas here in California is made glad with warm sunshine and brilliant verdure; we are spared the rigor of winter and the desolating touch of frost. Scarcity of coal does not trouble us; the lack of food does not occasion anxiety; our community is rich and happy; the cries of the destitute may cross the stormy Atlantic, but they are faint by the time they reach us; the call of the hungry in lands wasted by war fades with the fragrant air that stirs our evergreen foliage. We are content, even complacent; we are tempted to thank God that we live in California and that we may keep detached from the miseries that befall others less comfortably circumstanced. With the sense of physical well-being comes a mental self-satisfaction that finds expression in the desire to keep aloof from the troubles and tribulations of the world outside. How far that feeling of detachment can go, to what depths of ignoble selfishness it may descend, is indicated by a letter appearing in one of our local newspapers, in which it is suggested that "a large muslin sign should be stretched across the altar of every church, saying, 'Learn How to Mind Your Own Business' . . . These seven words if debated on the way home would be equal to a sermon". This sentiment is endorsed by the editor, who, in smoother phrases, plays on the same rotten string, preaching irresponsibility for the plight of Europe and callous disregard of the difficulties that have befallen the nations with which we stood recently in battle as comrades in a great cause. The sympathy expressed for the friendly nations is hardly distinguishable from the cold tolerance shown for the enemy countries. Our Christmas message to friend

and foe alike is, apparently, "Mind your own business and we will mind ours; you have your troubles, we have some of our own; the War is over; let each go his way". Perhaps an older cynicism will serve to express the same idea: "Each for himself, and the Devil take the hindmost". One might think so, reading the newspapers with which San Francisco is afflicted, but fortunately they reflect neither the best thought of this community nor the real sentiment of the American people, which is nothing if not generous, and evermore responsive to the ideals of free men. In the Book that was handed down by the Pilgrim Fathers, and has inspired Christian civilization in this and other countries for two thousand years, we remember reading a different message. In a land recently the scene of modern warfare, tanks included, there walked a teacher of gentle mien, who spoke of a second of two great commandments that was like unto the first, and it was: "Thou shalt love thy neighbor as thyself". That sentiment is the very breath of Christianity and the very soul of Civilization; it separates the cosmic struggle of existence from the human progress that is founded on a code of ethics; it divides the state of nature from the organization of society; it marks man's effort to escape from the rapine of the jungle to the amenities of a peaceful community. The shriveled soul that suggested the desecration of the churches by the blatant advertisement of his innate meanness is a recreant to civilization; he is so little the heir of all the ages of man's constant effort to mitigate the cosmic struggle by human kindness that he seems to be a throwback to the savagery from which his fellows have painfully emerged. Let us forget him; his creed is not ours. The memories of the last five years are too searing to be easily disregarded; the meaning of our dedication to a great cause is yet to be fulfilled; what shall it profit a nation if it gain all the gold in the world and lose its own soul?

National Resources

Amid so much that is merely confusing, if not destructive, it is a pleasure to read the annual report of the Secretary of the Interior. We have not seen the full text, but the excerpts given in the 'New York Times' suffice for friendly comment. This last report from the Department of the Interior has special interest because it has been announced that the Secretary, Mr. Franklin K. Lane, expects shortly to resign. Rumors to this effect have been frequent for several months, it being reported that Mr. Lane has been offered a highly remunerative appointment in New York. With him will go one of the few able members of the President's cabinet, which has been remarkable for its mediocrity of talent. Mr. Lane has imagination and foresight; he shows sympathy with those engaged in the industrial development of the country and a clear understanding of the character of our natural resources. A Californian by birth, he knows the West, and during his term of office he has proved a good friend to the bureaus that are engaged in giving scientific aid to the miner. He refers to the coal strike and points at the fact that "we live virtually by unanimous consent", because if less than one-half of 1% of our population quits digging coal, we are threatened with famine and pestilence. He refers to the seasonal fluctuation in the demand for coal as responsible for many of the difficulties leading to the strike. Obviously what is needed is some means for storing coal without detriment to its quality. Although we have only 8% of the world's population, we produce 46% of all the coal consumed. A well regulated export trade would balance the fluctuation in the domestic demand for fuel. Wastefulness, of course, is another item in the account. "At best one-fifth of our coal is wasted", says the Secretary. Next comes the proper use of our water-powers. Of the horse-power in prime movers, 70% is east of the Mississippi, whereas of the available water-power 70% is west of that river; therefore, says Mr. Lane, "unless the East is to lose its industrial supremacy, it must press, and press hard, for the development of all water-power possibilities". From a national standpoint, it does not matter whether East or West holds the industrial supremacy, but it does matter whether our waterfalls and torrents are allowed to run unproductively, in neglect of their capacity to lighten human toil. Other subjects of timely interest are discussed in the annual report. We are compelled, for lack of space, to pass to "the conservation of the American man", concerning which Mr. Lane has many useful things to say. He says that this is "the most neglected of our resources". For example, 25% of the 1,600,000 men between 21 and 31 who were first drafted into the Army could neither read nor write our language, and tens of thousands could neither speak nor understand it. To them the reported doings of Hindenburg or of Hoover were alike transmitted only by word of mouth, if at all. Mr. Lane has written and spoken often on this topic during the last three or four years, and he has performed a national service by doing so. The War has made the American people conscious of its heterogeneity and aware of the need for promoting homogeneity by benevolent assimilation, through education, of the mass of undigested Europeanism that exists in the body politic. This democracy cannot exist half-American and half-alien; the old leaven of New England, not the new yeast of Russian, German, or Irish origin, must prevail if the United States is to follow the destiny to which it was called by Washington, Lincoln, and Roosevelt. The Army has done splendid work as a school for Americanism, not Americanitis, which is an ugly travesty of patriotism. The War Department offered a course in English, followed by full citizenship, to aliens who enlisted for three years. This educational scheme proved extraordinarily successful. We hope that it will be continued upon an increasing scale; the education together with the discipline has proved wonderfully effective in turning the raw material from Europe into a good American product. The spirit of the experiment was right; it was sympathetic. That is the only spirit in which to tackle this fundamental problem, which has become so insistent since the War.

Mr. Sulman and Flotation

The Editor:

Sir—Will you allow me to say a few words in extenuation of Mr. Sulman's "unscholarly failure to make the customary references to previous writers on his subject".

I hold no brief for Mr. Sulman and certainly none for Minerals Separation, Ltd. In fact, no engineer has suffered more from the vindictiveness of this company than myself, extending over now nearly ten years; yet I am without rancor or animus.

Mr. Sulman is simply suffering from the same cause, directed by the same intelligence, which directs the rest of the objectionable policies of this metallurgical octopus. Most of the matters in Mr. Sulman's paper which are now newly published were written ten years ago and were embodied in a treatise referred to in the preface of my book, 'Concentrating Ores by Flotation'. This treatise has been suppressed by the Minerals Separation, Ltd., during all these years along with much other information which should have been published as a matter of good morals and good citizenship. But it was suppressed, and now that a belated permission is granted Mr. Sulman to publish his ideas, he apparently cannot orient himself to the fact that in the ten years in which he has supinely not quarreled with his bread and butter, other men have discovered and published most of his ten-year old original thoughts. He still seems to be in the atmosphere of ten years ago; a good instance of the blight spread over technology by this company.

I think you censure Mr. Sulman with a little too much harshness, Mr. Editor, for his seemingly unscholarly mannerisms; the blight which has prevented his publication has also extended to his reading; and therefore the charitable view is that he is unaware of his transgression.

No such a charitable view would seem justified, however, in the matter of his laudation of the brain of the octopus. This would seem to a candid observer to be simply the price paid for permission to publish.

THEODORE J. HOOVER.

Leland Stanford Junior University, December 15.

Smelting Iron Ores

The Editor:

Sir—In your issue of December 6 is a communication from F. H. Mason in which he says that "the bulk of the accessible ore on the Pacific Coast is magnetite, which cannot be reduced by ordinary blast-furnace practice without an addition of more reducible iron ore".

This is so diametrically opposed to the fact of furnace practice that it cannot be permitted to pass without denial.

DAVIDH E. WOOLSTON.

Duluth, December 8.

American Mining Congress

The Editor:

Sir—In your issue of December 6 there appears an article replete with witticisms, satire, and some direct statements criticizing the American Mining Congress. In justice to this organization, it appears to me that further light should be shed on this subject.

In the editorial to which reference is made, after commenting on the plans of enlargement of the Congress, the following statement appears: "In short, the Congress is to organize a Bureau of Mines." The plan of the Congress, to secure information relating to the mining industry for the benefit of its members, is referred to as "grandiose", and "fine and large"; the latter doubtless is intended as irony or sarcasm. It is further set forth that the Bureau of Mines is fulfilling to the satisfaction of all the offices that the Congress purposes to fill.

In order to consider the righteousness of the charges against the American Mining Congress there is offered herewith a quotation from the revised Organic Act (37 Stat., 681), under which the Bureau of Mines was organized:

"Sec. 2. That it shall be the province and duty of the Bureau of Mines, subject to the approval of the Secretary of the Interior, to conduct inquiries and scientific and technologic investigations concerning mining, and the preparation, treatment, and utilization of mineral substances with a view to improving health conditions and increasing safety, efficiency, economic development, and conserving resources through the prevention of waste in the mining, quarrying, metallurgical, and other mineral industries; to inquire into the economic conditions affecting these industries; to investigate explosives and peat; and on behalf of the Government to investigate the mineral fuels and unfinished mineral products belonging to or for the use of the United States, with a view to their most efficient mining, preparation, treatment, and use; and to disseminate information concerning these subjects in such manner as will best carry out the purposes of this act."

The following is quoted from literature of the American Mining Congress:

"The American Mining Congress is a voluntary asso-

cation supported by the fees and dues of its members. It is striving to bring about:

"First: Safety and efficiency in mining operations.

"Second: Intelligent conservation with a view to the highest utilization and the prevention of waste of mineral resources.

"Third: The protection of mining investors against fraud and misrepresentation; the stimulation of investment in real mining and to demonstrate that mining is a business and not a gamble.

"Fourth: Uniformity in State laws governing mining operations carried on under like conditions.

"Fifth: Such Federal co-operation through research and investigations as will solve those problems of production, treatment, and transportation which are essential to the highest development of the Mining Industry.

"Sixth: A solution of the economic problems underlying the coal industry.

"Seventh: A more complete co-operation between miner and operator through the settlement of disputes by the economical rule of reason, rather than by the wasteful method of strikes and lockouts, and to foster in every possible way those conditions which make for just, considerate, and helpful employers and well paid, efficient, and loyal workmen."

It is obvious that while the purposes of these two organizations are similar, the aims of the Congress, numbered third, fourth, fifth, and seventh are not covered in the organic Act under which the Bureau of Mines was established. However, this does not exemplify the great difference between the two organizations, namely, the methods of accomplishing their respective purposes. It is well known that the Bureau of Mines has no police power, and that its work is done by co-operation with officials of mining and metallurgical operations. In order to secure this co-operation, assurance is usually given to operators by officials of the Bureau of Mines that information secured from them will be held confidential. Obviously, such information is not open to the public, except as it may eventually be given publicity through the periodicals of the Bureau of Mines. It is pointed out that, on account of the length of time required for many of the Bureau's investigations, lack of funds, and other causes, two or three years might elapse in some cases before the results of certain investigations can be published.

The activities of the American Mining Congress are not fettered by Government regulation. The Congress is a free agent, working in co-operation with the Bureau of Mines. Its greatest field of activity is in connection with legislation affecting the mining industry, a field which cannot be covered by the Bureau of Mines. Let us suppose, for instance, that some ill-chosen legislation is proposed in Congress, and it is desired that certain information be brought immediately to the attention of our lawmakers at Washington. The Bureau of Mines probably could not supply the needed information on account of the nature of its investigations, or the fact that its policy is to regard as confidential any information that might have been secured. The final report of the Bureau on the subject in hand might easily be too late for use by a year or two. Obviously, the Bureau of Mines cannot be of use to the mining industry in political affairs; that field can be covered by the American Mining Congress. Those who are conversant with the accomplishment of the Congress in this direction know that this organization is essential to the welfare of the mining industry.

To intimate that the American Mining Congress is unnecessary because of the existence of the Bureau of Mines is tantamount to saying that because we have a Department of Agriculture, there is no necessity for an organization of farmers; because we have a Department of Labor, there is no necessity for organizations of employers or employees; because we have a Treasury department, there is no necessity for the existence of private banks. In short, why have any organizations of any kind in this land of ours, because we have a Federal government?

In the latter part of the editorial the words "absurd", "foolish project", and "blunder" are used to characterize the proposed activities of the Congress. The organization chart of the Congress (and no efficient organization should be criticized for having such a chart) is humorously described as "one big black balloon attached to six baby-balloons".

The editorial ends by admonishing Mr. Callbreath, the secretary of the Congress, to 'stick to his knittin' ". Had the author of this statement been present at the annual meeting of the Mining Congress at St. Louis in November last, and had he there heard the unanimous resolutions of thanks to Mr. Callbreath and other officials of the Congress for their accomplishments on behalf of the industry, he would have realized that representatives of mining from every part of the United States consider that the Congress is "sticking to its knittin' ". The proposed plan of enlargement will enable it to stick even closer and accomplish more good for the mining industry.

EDWIN HIGGINS.

San Francisco, December 15.

[We are glad to publish this letter from Mr. Higgins. We agree with him that "the greatest field of activity" of the Mining Congress "is in connection with legislation affecting the mining industry, a field which cannot be covered by the Bureau of Mines". That is exactly the point we were trying to make; when we advised Mr. Callbreath to "stick to his knittin' ", it was because we held, as stated in the editorial under discussion, that the proper function of the Mining Congress "is to serve as a permanent lobby at Washington in behalf of the mining industry".—EDITOR.]

ORES of tin are scarce in the United States, and their occurrence in Alaska is therefore of interest. Stream tin has been found in gold placers in the Ruby district at several places, but not in quantities large enough to pay for mining it except as an accessory to the gold. A short discussion of the tin in this district by Theodore Chapin is given in Bulletin 692-F, U. S. Geological Survey.

Technical Operations on the Suan Concession, Korea—V

The Suan Mill. Treatment of Tungsten Ore.

By A. R. WEIGALL and J. F. MITCHELL-ROBERTS

THE MILL. The equipment includes (see Fig. 1):

1. Grizzley 8 by 3½ ft., slope 42°.
2. Primary crusher 10 by 16-in. jaws.
3. Secondary crusher 6 by 16 in.
4. Ore-bin 35½ ft. long by 13½ ft. wide by 16 ft. deep; capacity, 400 tons.
5. Suspended Challenge type of feeders.
6. Stamp-batteries. 20 stamps in section or 40 in whole mill.
7. Pierce amalgam-traps.
8. Amalgamating plates 26 in. wide by 72 in. long.
9. Hydraulic classifier.
10. Classifying cone 3½ ft. diam. by 3 ft. deep.
11. Kyloe thickening-tank.
12. Deister simplex sand-table.
13. Wilfley sand-table.
14. Card tables.
15. Re-cleaning table, Suan pattern.
16. Amalgamating-barrel and pan.
17. Drying-floors (not shown, see Tul Mi Chung mill).
18. Sloughing-off cone 4 by 4 ft.
19. Dorr duplex classifier.
20. Tube-mill 5 by 22 ft.
21. Abbe-Frenier sand-pump 20 by 55 in.
22. Callow thickening-cones 8 ft. diam.
23. Primary flotation machine.
24. Secondary flotation machine.
25. Cascade frothing-trap.
26. Canvas plant.

The product of the mill is in the form of gold and silver bullion recovered by amalgamation, gold-silver-copper-bismuth concentrate from table concentration, and gold-silver-copper flotation concentrate. The small amount of high-bismuth concentrate obtained from the re-cleaning of the flotation concentrate, is added to the table concentrate. Formerly a separate high-grade bismuth product was split out from the head streak of the tables and also from the re-tabling of the canvas-plant concentrate, but this practice is now abandoned, only one class of table-concentrate being produced. Experiments are now in progress with the object of collecting the bulk of the bismuth in a smaller tonnage of much higher-grade bismuth concentrate. The smallest possible tonnage would then be sold on a bismuth basis, on which the smelters charge a high tariff, and the main bulk of the concentrate would be sold on a gold-silver-copper basis, neglecting the small percentage of bismuth it still contained.

CRUSHING. After sorting out by hand about 7% of waste from the run-of-mine, the sorted ore is delivered to the mill in 2-ton cars, which are weighed at the head of the mill, a moisture sample being taken. The ore is dumped directly into two taper-bar primary grizzleys, 8 ft. long by 3 ft. wide, one to each 20 stamps, set at an angle of 42°. The openings between the grizzley-bars are 1¼ in. and the undersize is delivered directly to the mill-bin, the oversize going to two primary crushers, one to each 20 stamps. These crushers are of the Hercules

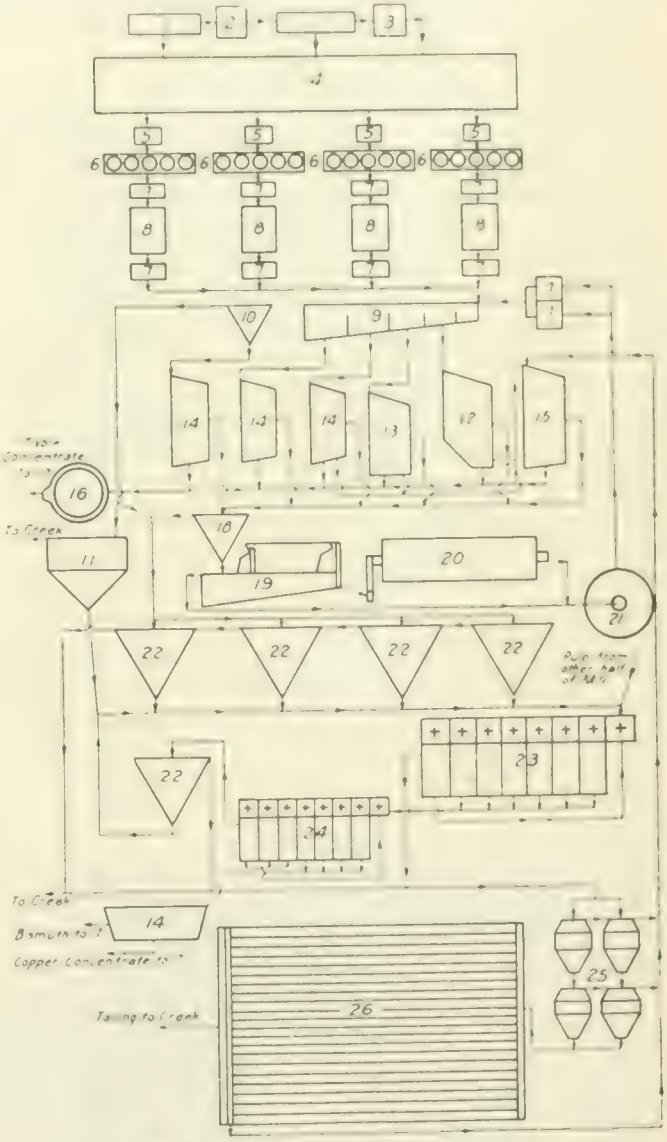


FIG. 1. FLOW-SHEET OF SUAN MILL

Blake type with jaw-openings 10 by 16 in., set to crush down to three inches. Each of these crushers has a capacity of 180 tons per 24 hours.

The delivery from the two primary crushers goes onto two secondary taper-bar grizzleys, one to each crusher. These are 6 ft. long by 4 ft. wide, with one-inch openings

between the bars, and set at a slope of 42°. The undersize goes to the mill-bins and the oversize to the secondary crushers, of which there are two. The secondary crushers are of the same type as the primary crushers, but set to crush down to one inch. Eighty-five per cent of the crushed ore in the mill-bins is reduced to less than one-inch size.

The speed of the primary crushers is 220 r.p.m., and of the secondary crushers 270 r.p.m. The power required for one primary and one secondary crusher is 28 hp. (peak) and one 50 hp. induction-motor, Westinghouse A.C. type H.F., 440 volts, 60 cycles, 575 r.p.m., drives a primary and a secondary crusher.

One set of cheek-plates and jaw-plates has a life of about eight months in both primary and secondary crushers, during which period they are turned end for end.

Ore-Bins. There are two flat-bottomed bins, one for each 20 stamps, each of a capacity of from 375 to 400 tons. These bins are each 35½ ft. long by 13½ ft. wide by 16 ft. deep. The feeders are of the standard Challenge type of suspended ore-feeder, one to each five stamps.

Stamp-Batteries. The frame is of a special four-post type with a central drive to each 10 stamps, formerly driven by one cam-shaft pulley of 6 ft. diam. and 18-in. face. This design did not prove satisfactory and resulted in an undue number of broken cam-shafts, which defect led to the substitution of two cam-shaft pulleys, each to drive five stamps. Those two pulleys are set together in pairs so as to be both driven by the same belt and motor. The faces of the pulleys are each 12 in. wide and turned so as to be 3/18 in. higher on the edge of contact to cause the 18-in. driving belt to ride evenly on the two pulleys. The pulleys are kept together by the cam-shaft collars and the thrust of the cams.

Power for each 10 stamps is provided by a 35-hp. induction back-geared Westinghouse A.C. type C.S., three-phase motor, 440 volts, 60 cycles. The speed of the rotor-shaft is 692 r.p.m. and of the counter-shaft 168 r.p.m. The driving pulley is 22½ in. diameter, crowned.

Each stamp weighs 1050 lb., made up as follows:

	Lb.
[illegible]	450
[illegible]	115
[illegible]	285
[illegible]	190
[illegible]	10

The cam-shaft is 6-in. diameter. The cams have a 9-in. lift and a 2½-in. face.

False dies are used to take half-worn shoes, these being placed upside down in the casting and used as dies. False dies of various heights are likewise employed to assist in maintaining a constant depth of discharge. By this practice the weight of the stamp is maintained, the shoes being removed when half-worn and new shoes substituted, the half-worn shoe then being used as a die. The best and most even wear on shoes and dies is obtained by using a chrome-steel shoe with a Pennington die, or the reverse. By this practice less cupping ensues than when the shoe and the die are both of the same material.

The average life of the various parts of the battery is as follows:

Parts	Materials and approximate life
Stem	Mild steel, four years
Tappets	Chrome-steel, two to four years
Heads	Chrome-steel, two to four years
Shoes	Pennington and chrome-steel, 100 to 120 days
Dies	Pennington and chrome-steel, 100 to 120 days
Cam-shafts	Hammered Norway iron, three months to three years
Mortars	Cast-iron, only one replaced in 10 years; broken by a gelignite plug
Liners	Manganese-steel, seven months to one year
Screens	Rek-tang, 20 to 50 days

The mortars are of the narrow Homestake quick-discharge type and weigh 8000 lb. each. They are lined with manganese-steel plates. The back liners are made in two sections; the top one being three inches wider than the bottom. This admits of changing the top liner, which is subject to the greatest wear, without disturbing the false dies or the remainder of the liners, which have practically twice the life of the back liners.

The mortar-blocks are of reinforced concrete, one continuous block accommodating four mortars with their corresponding eight posts. A ⅜-in. rubber mat is placed between the concrete and the mortar. The shoes of the battery-posts rest on a 12 by 12-in. pine block embedded in the concrete. Pacific guides are used on all batteries in the mill. The cast-iron bushings have a life of approximately one year.

The stamps operate at 104 drops per minute. The height of drop is 9 in. for the central stamp, 8¾ in. for the two adjoining stamps, and 8½ for the two end stamps. The order of drop is 1-4-2-5-3. The screen-frames are made the full size of the opening in the mortar. After trying various types, only Rek-tang screens are now used; these have openings of 0.04 and 0.035 inch. The lower half of the frame is covered with 0.04-in. screen and the upper half with 0.035-in. screen. In order to increase the stamp-duty, the lower edge of the screen is given an inset of two inches, bringing it within 1½ in. of the die. An average depth of discharge of 2½ in. is maintained and the bed of ore on the dies kept as thin as possible without allowing pounding. The battery feed-water is introduced at the two ends of the ore-chute. The ratio of water to ore in the battery is from 4.5:1 to 5:1, and occasionally reaches 6:1, this proportion being necessary on account of the high specific gravity of the ore and the difficulty of keeping the plates and traps clear. Our practice, while increasing the stamp-duty, has a tendency to loosen and carry away amalgam as well as to scour the plates. An average stamp-duty of from 6.5 to 7 tons per 24 hours is obtained. A duty of 9.17 tons per 24 hours has been reached for a month and an average duty of 8 tons has been maintained for a period of several months, but the ore now milled is harder than formerly and the average stamp-duty has dropped to 6.75 tons.

Amalgamation. While inside amalgamation is not practised in its true sense, there being no chuck-plates, quicksilver is fed to the batteries every half-hour, the amount being regulated by the condition of the amalgam on the apron-plates, which is kept rather stiffer than is usual. As the battery-pulp is fed directly into a Pierce

BULL PACKING CORD WOOD

A COOLIE ENJOYING A SMOKE

trap that is replaced every morning, very little change is noticed on the plates during the early part of each day and until the amalgamated surfaces of the trap get into condition; so that for this period the amount of quicksilver fed to the mortars has to be guessed. During this period, however, it is not so important that the exact amount of quicksilver should be added, because the trap-plates contain an excess of mercury after being freshly dressed. The average amount of quicksilver fed into the boxes is 0.17 oz. per ton of ore milled.

The pulp from the mortar flows directly to a Pierce amalgam-trap, 26 by 24 in., set at a fall of five inches per foot. The trap discharges onto an apron-plate of $\frac{1}{8}$-gauge copper, 27 in. wide by 72 in. long, set at a fall of one inch per foot. The head traps and apron-plates are cleaned every morning and the tail traps every other morning. The apron-plates are dressed every four hours with a solution of ivory soap and borax. An occasional dressing with a solution of caustic soda is also given. After the removal of amalgam, the trap-plates are dressed with a weak cyanide solution (0.2%KCy), and then placed in a bath of mercury. Any excess of mercury is removed with a short worn whisk-broom, and the plates stood on end to drain. Thus they go to the traps quite wet. Plates require re-silvering about once a year. This is done at the mill, two ounces of silver per square foot of plate surface being used.

The narrow width of the apron-plates is due partly to the width of the Pierce traps, but is also accountable to the fact that the larger part of the amalgam is caught in the head trap. The amount caught on the apron-plate is practically all deposited on the upper half and what passes this portion does not stick again, but is caught in the tail trap. At first apron-plates of the usual size were used, but, with the introduction of Pierce traps, the plates were reduced to their present dimensions without any falling off, but rather an increase in the proportion of gold recovered by amalgamation.

Apparently the small amount of bismuth sulphide in the ore has no bad effect on amalgamation. However, when treating concentrate containing 3 to 4% of bismuth in an amalgamating-barrel, there is a large loss of quicksilver, probably due to 'sickening' caused by the bismuth, and a considerable amount of the bismuth is amalgamated.

Two additional Pierce traps are placed at the tube-

IN TUL MI CHUNG VILLAGE

THE SUAN MILL, FROM THE RIVER

mill discharge, a small amount of quicksilver being added every half-hour to the tube-mill feed, the average amount being 6 oz. per 24 hours. Although coal-tar and lime are fed to the tube-mill, forming a certain amount of froth, this in no way appears to retard subsequent amalgamation in the Pierce traps, since the submerged portions of the amalgamated plates in the trap remain clean and bright. These tube-mill traps are removed and cleaned once every three days. Spare Pierce traps are kept, so that when one trap is removed from circuit to be cleaned, a clean trap is immediately inserted in its place.

The average recovery of gold by amalgamation in this mill is from 75 to 77% of the gold in the ore. The amalgam is caught as under:

	%
In battery, Pierce traps, and on apron plates	89
In tube-mill and Pierce traps	9
Miscellaneous, launder, etc.	2

The amalgam recovered is 32% gold.

A considerable amount of vagrant amalgam finds its way into the table-concentrate. In order to recover this, and also to obviate the difficulty in obtaining close agreement between the mine and the smelter assays on samples of concentrate, caused by erratic gold assays due to prills of amalgam in the concentrate, the table-concentrate in recent years has been treated in an amalgamating barrel and pan. Not only was most of the amalgam in the concentrate recovered in this way, but also a portion of the fine gold in the concentrate that escaped amalgamation was thus saved. Owing to the amount of bismuth in the concentrate (3 to 4% bismuth) there is a relatively large loss of mercury in this operation and also the amalgam recovered is rather base, but the results obtained fully warrant our procedure, which not only increased the gold recovery by amalgamation but greatly reduced the number of discordant and 'spotty' assays on samples of smelter shipments. During 1918, the practice of amalgamating the concentrate in this manner had to be abandoned owing to the cost and difficulty of obtaining a sufficient supply of mercury under the war restrictions.

The amalgamating-barrel is 2 ft. diam. by 3 ft. long, revolved at 20 r.p.m. The amalgamating-pan is made of ¼ in. sheet-iron, the bottom being part of a discarded Challenge feeder. The diameter of the pan is 3 ft. and the depth 9 in. A solid cast-iron ball, 8 in. diam., revolves in the pan, which is set at an angle in the manner of the Berdan pan. The pan has a speed of 20 r.p.m. A better plan would be to use a 4-ft. Berdan pan, taking concentrate direct from the tables with continuous overflow of treated concentrate into bins, and to clean-up the pan once or twice every shift. The loss of quicksilver in the barrel and pan amounts to from 5 to 8 ounces per ton of concentrate treated, depending on the percentage of bismuth in the product.

The total amount of quicksilver used in the mill averages 0.77 oz. per ton of ore milled. The loss in milling averages 0.1 oz. per ton of ore milled. The total quicksilver loss, including the loss in the treatment of concentrates, amounts to 0.27 oz. per ton of ore milled. The amalgam is retorted in the usual way. The gold is melted into small bars, which are sampled, weighed, and then mailed to the Osaka mint.

Classification and Table-Concentration. The pulp from the tail traps of each four batteries flows in one common launder to one Deister classifier with no spigot, but with a sufficient flow of clear water to keep the content in movement but not in violent agitation. This classifier has proved a most efficient amalgam trap, although, owing to the amount of water necessary to keep this heavy pulp from settling, some amalgam does escape. The pulp is then split, one-half going to a four-compartment spitz, made at the mine, and the other half to a launder classifier provided with four Deister classifiers. This arrangement has superseded the Callow cones and the two six-compartment Richards classifiers.

From 0.2 to 0.4 lb. of lime per ton of ore milled is added as milk-of-lime to the pulp coming from the batteries. The object is to assist in settling the slime overflowing from the classifiers, which discharge into Kyloe type of dewatering and thickening tanks.

The overflow from the classifiers is laundered to two Kyloe tanks. A description of these tanks is given in a paper by J. W. Ashcroft entitled 'The Flotation Process', read before the Institution of Mining & Metallurgy on December 17, 1912. The only modification in the design of the thickeners at the Suan mill from those described in the above-mentioned paper, is that baffles of ordinary corrugated roofing-iron are used in place of the plain baffle-boards described by Mr. Ashcroft, and also a small sloughing-off cone is placed immediately ahead of the Kyloe tank to cut out any heavy oversize that may have passed the classifiers at the battery. It has been found that the presence of this heavy oversize in the Kyloe tank gives trouble by plugging the spigot-discharge. The sloughing-off cone is 2 ft. 6 in. by 3 ft. with a ¾-in. spigot. So long as the feed to the Kyloe tanks is only composed of slime, and the heavy sand is removed, these tanks are very satisfactory, the overflow from them consisting of nearly clear water. The thickening cones and Kyloe tanks are provided with quick-acting flap-valves to facilitate starting the plugged spigots with a minimum loss of pulp.

The thickened pulp from the Kyloe tanks and the sloughing-off cones goes direct to flotation.

The underflow from the classifiers is delivered to concentrating tables. Originally the mill was equipped with James tables throughout, but these were replaced by Deister sand and slime tables. These in turn were superseded by Deister plateau roughing and finishing tables (Deister Machine Co., large simplex table, 1914 model, speed 240 to 245 strokes per minute, stroke ⅝ to ¾ in.), Wilfley sand-tables, (speed 240 strokes per minute, stroke ⅝ to ¾ in.), and Card tables (type Hendrie & Bolthoff model C., 1914, with grooved linoleum decks, speed 245, 250, and 260 strokes per minute, stroke ¾, ⅝, ½, and ⅜ in.; the shorter stroke and higher speed for the finer material). The Deister roughing and finishing tables are run at 245 strokes per minute, which speed, although not fast enough for this ore, seems to be the limit owing to the heavy weight of the table.

Originally the practice was to make two products from the tables by cutting out the rich streak at the head of the table as a high-grade bismuth-gold-copper-silver

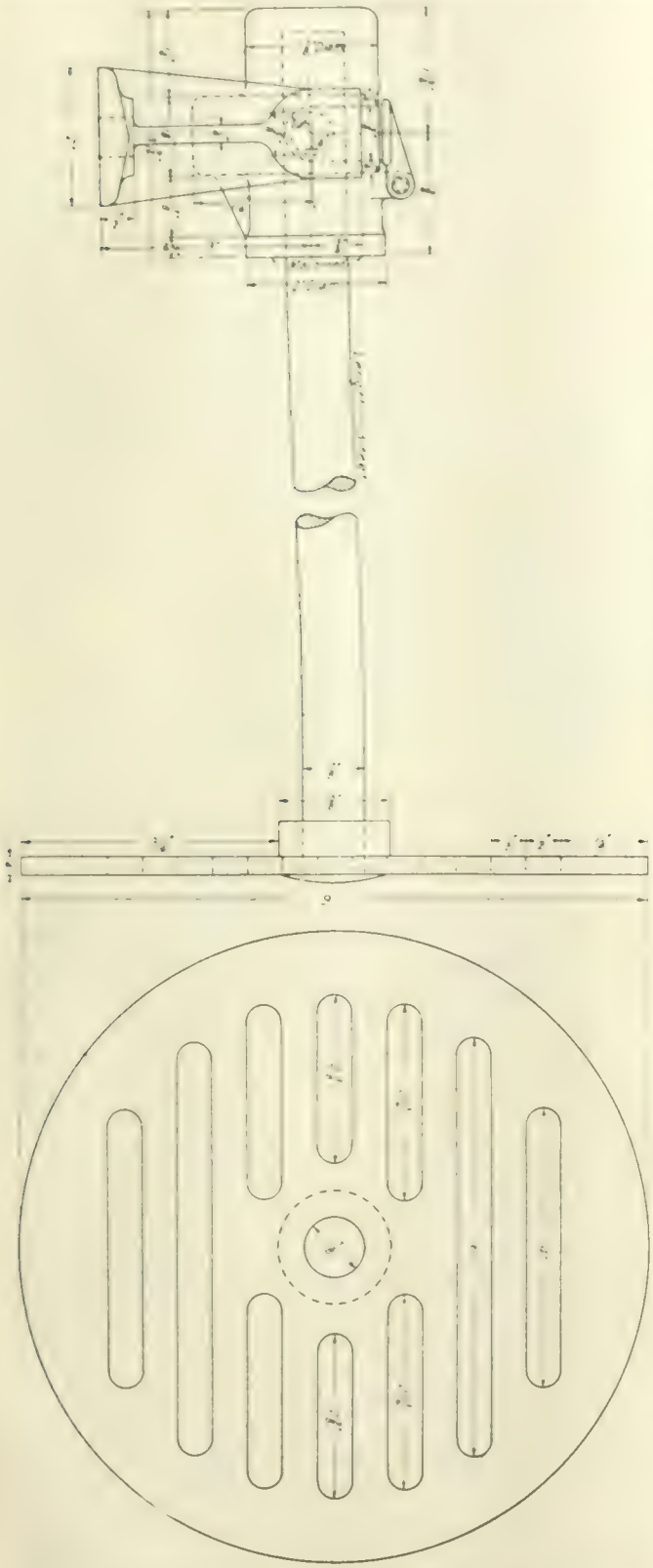


FIG. 2. REVOLVING SLOTTED DIAPHRAGM FOR DISCHARGE OF PEBBLE-MILL

product selling the remainder of the table-product on a non-bismuth basis. Later, this product was abandoned in favor of making a single table-product. This concentrate contains from 60 to 100 dwt. gold per ton, 25 to 30% copper, 4.5 to 5% bismuth, and 6 to 10 oz. silver per ton. The average for 1918 was

Gold, dwt. per ton	74.64
Silver, oz. per ton	7.72
Copper, %	27.4
Bismuth, %	5.49

The grade of ore milled during this year was below average and the above-quoted results for 1918, with the exception of the copper percentage, are in consequence lower than the usual grade of concentrate, especially as regards bismuth.

The recovery of copper by table-concentration is relatively low, since the main object is to produce the highest possible grade of concentrate to meet with the smelter requirements and a heavy transportation charge, and full reliance is placed on the flotation department to recover the greater portion of the copper that is not saved by table concentration.

The table-concentrate is sent to the drying-house, where it is dried, sampled, sacked, weighed, and sent to a smelter.

TUBE-MILLING. The tailing from table-concentration is laundered to a sloughing-off cone set so that the spigot delivers to a Dorr duplex classifier, at a point two feet ahead of the classifier overflow. The sloughing-off cone has the following dimensions: diameter inside annular launder, 3 ft. 4 in.; outside, 4 ft.; depth, 4 ft.; perforated diaphragm, 8 in. from the bottom; hole at bottom, 2 in., better if 2½ in.; hydraulic attachment consists of a 3-in. T-piece with 1-in. water-pipe and valves; feed-cylinder, 2 ft. deep by 18 in. diam. Iron plugs are inserted as spigots bored to varying diameters, ¾, ⅞, and 1-inch, and changed to suit variations in feed and the amount of plus 100-mesh oversize in the overflow.

The Dorr classifier is 15 ft. long by 4 ft. 6 in. wide, set at a slope of 2⅜ in. per foot. The classifier can handle the table-tailing when 30 stamps are dropping, but is overloaded with the whole 40 stamps in operation. We found that by increasing the speed of the classifier from 20 to 22 strokes per minute, it was able to handle the whole of the table-tailing without any overloading.

The spigot of the sloughing-off cone is adjusted so that a minimum of plus 100-mesh product flows off with the cone-overflow and a minimum of minus 100-mesh product is delivered to the classifier. The overflow from the sloughing-off cone goes to four 8-ft. Callow thickening cones, the thickened product from which goes direct to flotation.

There are two tube-mills, one being a spare. These are 5 ft. diam. by 22 ft. long, made by the Power & Mining Machinery Co. They are operated at a speed of 27 r.p.m. by a 50-hp. slip-ring Westinghouse A.C. type H.P. induction-motor, three-phase, 60 cycles, 440 volts, 575 r.p.m. It would be preferable to have a motor of greater capacity, say 70 hp., as when running at full load, especially with an increased pulp dilution in the mill, the motor is from 10 to 15% overloaded. Maximum grinding efficiency is obtained with a pulp dilution of 40% water. In practice, the average dilution is from 48 to

50% water. The pebble load is maintained so as to keep the mill about half full. This is judged by the pebble feed, which is through the feed-scoop. Pebbles are fed every day to a point where the mill refuses to take more, that is, an occasional pebble drops back into the scoop from the charge.

The tube-discharge joins the classifier-overflow and both are pumped to two Pierce amalgamating traps, 32 by 24 in. The discharge from these traps joins the tailing from the concentrating tables and flows to the sloughing-off cones above the Dorr classifier, thus putting the tube-mill, classifier, sloughing-off cones, and Pierce traps in closed circuit. The pump used for elevating the classifier-overflow and tube-mill discharge to the Pierce traps is a No. 1 Frenier pump, barred 52 by 20 in., the discharge orifice is 3 in. diam., stand-pipe 4 in. diam., speed 19 r.p.m., height of lift 17 ft. 8 in., capacity 5000 gal. (U. S.) per hour. The energy required to operate this pump is from one to two horse-power.

As no payment is made for bismuth when the percentage of this metal in the concentrate falls below 1.8%, it is now proposed to further elevate the tube-mill discharge so as to join the feed of the concentrating tables, thus giving the re-ground material a second tabling, with the object of obtaining as much as possible of the bismuth in a marketable product.

In the early operation, the tube-mills were lined with imported five-inch silex bricks, and Danish pebbles were used for grinding. When the supply of foreign materials was practically cut off by the War, use was made of pieces of extremely hard ore, from the Suan mine, as lining. This material was dressed into blocks and proved almost as satisfactory and durable as the silex bricks, and was, of course, much cheaper. Cast (white) iron lifting-bars in sections 3 ft. long, 7 in. high, 1¼ in. thick at base and ¾ in. at top, are inserted the full length of the mill between every two rows of lining-blocks, and this practice has greatly lengthened the life of the linings as well as increased the grinding efficiency. Such a lining has a life of from 8 to 12 months. With the depletion of the supply of hard mine ore for lining, blocks of a hard dolerite, which occurs close to the mill, have been used, and these dolerite blocks appear to give about as good service as the hard-ore linings.

A satisfactory substitute for imported pebbles was obtained from the beaches on some of the islands off the coast of Korea. The Korean pebbles, while not so good in shape nor so hard as the imported, gave a satisfactory grinding efficiency with a slightly heavier pebble consumption, the relative consumptions being 2 to 2½ lb. of imported pebbles per ton of tailing as compared with 3 to 4 lb. of Korean pebbles. The specific gravity of the imported pebbles is 2.59 and that of the Korean pebbles 2.65 to 2.70. Since the price of Korean pebbles delivered at the mill is only approximately one-quarter the price of imported pebbles the former proved much more economical. Owing to the increasing difficulty and the cost of transport during 1918, and also a falling off in the supply of Korean pebbles, an efficient substitute has been found in 3 to 4-in. roughly dressed cubes of the hard dolerite of which the mill-linings are now composed. The corners and edges of these dolerite blocks wear down quickly, when they form a satisfactory grinding pebble. They are much cheaper, of course, than either of the types of pebbles formerly used.

The lifting-bars in the mill-linings are not only of service in prolonging the life of the linings and increasing grinding efficiency, but also the tumbling action produced by the projections soon rounds off the corners of the dolerite blocks and produces a fairly well shaped pebble. From an economic point of view the dolerite-pebble blocks give the best results, as with their use the increase in the mill oversize has been small.

The Suan ore is not so abrasive as the Tul Mi Chung ore, and the above-mentioned pebble consumptions are less than those obtained in grinding Tul Mi Chung ore in 8 ft. by 36-in. Hardinge pebble-mills. The following analyses give a general idea of the grinding results obtained in this mill.

Typical Screen-Analyses

Mesh		Battery feed	Battery discharge	Tube-mill feed	Tube-mill discharge	Flotation feed
On	1	11.9	...	...	...	...
"	2	44.3	...		...	...
"	6	21.0	...	...	...	...
"	10	5.3	...	...	...	...
"	20	5.3	5.00	5.00	...	...
"	28	...	7.00	7.00	...	...
"	35	4.0	7.00	7.00	3.75	...
"	48	1.3	6.00	6.00	3.00	...
"	65	2.2	8.00	8.00	6.00	1.75
"	100	1.3	10.00	10.00	7.00	5.25
"	150	...	11.00	11.00	13.50	14.56
"	200	2.0	9.00	9.00	10.50	12.44
Through	200	1.4	37.00	37.00	56.25	66.00

Dolerite blocks for pebbles cost $2.25 per ton delivered at the mill as compared with $12.50 for Korean pebbles and $47.50 per ton for imported pebbles. The average pebble consumption per ton of ore milled is as follows: imported pebbles, 2½ lb.; Korean pebbles, 4 lb.; and dolerite blocks, 5½ lb. per ton of ore milled.

Canvas Plant. The tailing from the cascade froth-trap goes to the canvas plant. This consists of 21 strakes each 30 in. wide and 50 ft. long, having a grade of one inch per foot, which is probably slightly too steep for the fineness and dilution of the pulp. The strakes are covered with 8-oz. canvas duck. As the tailing only contains approximately 5% oversize on a 100-mesh screen and as head-room is limited, no classification is made at the top of the canvas plant. The area of the canvas plant is not sufficiently large for the amount of tailing treated; probably it should be twice as much.

The concentrate saved in the canvas plant is of low grade. The former practice was to re-table it on a Deister slime-table and produce a separate product, but this was abandoned in favor of adding it to the Pierce traps at the battery and thus subjecting it to a complete re-treatment.

Thus the mill now produces only three products, namely, gold bullion and two classes of concentrate, that is, table concentrate and flotation concentrate. The part of the flotation concentrate is separated out as a high-bismuth product on a Card table. The gold bullion has an average fineness of 750. The concentrates produced have the following average grades:

	Gold dwt	Silver oz	Copper %	Bismuth %
Table concentrate	8.00	11.50	0.50	1.5
Flotation concentrate	7.60	4.00	27.60	1.5
Card table (mouth of secondary machine)	13.00	20.00	42.00	6.0

TREATMENT OF OTHER ORES. The ores from some of the prospects on the Concession in course of development present sundry features of interest.

In stamp-milling it was found necessary to use finer screens than those in use for the Suan ore; so a 0.03-in. aperture screen was used. The extraction by amalgamation was 44.02% of the gold in the ore, this being relatively low but fairly satisfactory when the grade of the ore and the amount of bismuth is considered.

Concentration on tables at first produced a low-grade concentrate that contained much bismuth; but a marketable product was the main point in table concentration. It was also found possible to separate out a tungsten concentrate that can be chemically treated to separate the tungsten from the other metals by the factory used on the mixed tungsten concentrate produced in the milling of the Soctarie tungsten ore to be mentioned hereafter. The flotation of the tailing from the tables was satisfactory, a good froth being produced without difficulty. The clean froth from the secondary machine was retabled on a Card table for the separation of a high-grade bismuth concentrate. Probably if the mill was arranged to operate entirely on this ore, improvement in the bismuth recovery would be possible by carrying out the re-

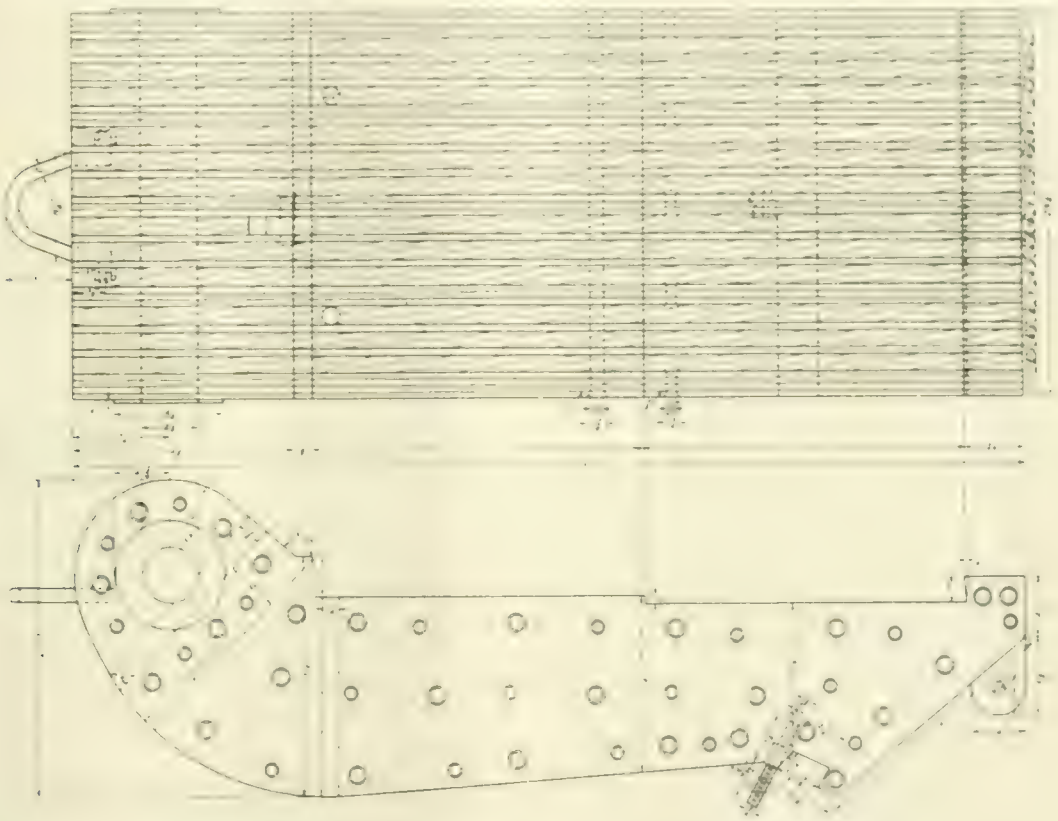


FIG. 3. DETAILS OF MADE-UP CRUSHER-JAW

product, owing to the large amount of magnetite. An arrangement for removing the magnetite was devised, with the result that practically all of it was eliminated from the concentrate. Card tables gave the best results on this ore.

The Peh Jai ore was treated at the Suan mill. This ore is quite complex and consists of a mixture of gold, silver, copper as chalcopyrite, bismuth sulphide, and scheelite, in an extremely hard gangue mostly composed of garnet and magnetite—a most refractory combination. The grade of the ore milled and the tailing produced are as follows:

	Ore $	Tailing $	Extraction %
Gold per ton	2.02	0.31	84.65
Copper per ton at 20c. per lb.	3.03	0.24	92.08
Bismuth per ton at 65c. per lb.	2.86	0.32	88.81
Silver per ton at 75c. per oz.	0.36	0.13	63.88
Scheelite per ton at WO_3 75c. per lb.	0.40	0.08	80.00
Total	8.67	1.08	87.54

concentration of the bismuth in steps and collecting the bulk of the bismuth in one product. No trouble was experienced in elevating the froth from the secondary-flotation machine, because this, after tabling, was completely broken down. If the mill was being run continuously on this ore, it appears that modifications in the canvas plant or possibly the use of Cornish rag-frames with glass surfaces would yield better results in bismuth and tungsten.

The products obtained in the milling of this ore were amalgam and four classes of concentrate of the following grades:

	Gold dwt	Silver oz	Copper %	Bismuth %	WO_3 %
Table concentrate	254.4	12.04	1.53	17.80	14.52
Flotation concentrate	13.3	8.28	20.00	4.01	
Middling	28.4	12.06	1.63	5.74	9.59
Flotation re-concentrate	86.0	....	9.38	23.52	..

The bulk of the other ores treated from the prospects

on the Concession have practically all their value in their gold and copper content; so that the treatment generally follows that of the Suan ore.

Tungsten Ores. The main deposit of tungsten on the Concession is a large but low-grade band of silicified limestone, almost approaching a quartzite in composition. The ore-band, which is about 25 ft. thick, is mined cheaply by quarrying, and despite its extremely low grade it can be milled at a profit. As the deposit is situated close to the Suan mill, it is treated in this plant, which, however, is not particularly suited to the treatment of an ore of this character. A test-milling of 32,531 tons of this ore was made in 1916 and 1917, from the results of which certain modifications were introduced into the mill and on the closing down of the Suan mine the whole mill of 40 stamps will be operated on tungsten ore. The estimated tonnage to be treated monthly is 9000 tons and the estimated operating cost for mining and milling is $2 per ton.

The average grade of the ore milled was: WO_3, 0.3%; gold, $0.45 per ton, and copper, 0.4%. On the results of the test-milling it is estimated that by producing a concentrate containing 20% WO_3 the following extractions will be obtained: gold 40%, tungsten 50%, and copper 25%. The low extraction of the copper is due to the fact that a considerable amount of it is present as oxidized mineral.

The main feature of the treatment of this ore is the production of tungsten in a marketable form. The whole of the tungsten produced in the former milling operations was concentrated up to a product containing from 60 to 65% of WO_3. This concentrate, however, contained from 1 to 2% of copper, and also gold. Not only was no payment made for the copper and gold, but a heavy penalty was extracted from the tungsten price on account of the copper impurity. To produce a clean tungsten product an option has been obtained for the right to use a recently patented process for the separation of tungsten from mixed concentrate, and, after a great deal of experimental work at the mine, it appears that the practical operation of this process is possible. The products are tungsten tri-oxide containing about 98% WO_3 and a residue containing the copper and gold contents, which, after re-concentration, can be brought up to a marketable grade.

Although molybdenite occurs widely around the Contact, no profitable orebody has been discovered. The same applies to the lead-zinc ores, and also to a deposit of gold-bismuth-telluride.

The power-plant of the company is situated at Pyeng Yang, some 55 miles from the Suan Concession. The plant is built on the south side of the Tai Tong river, below the railway-bridge and is about two miles from the centre of the city.

The supply of water is drawn from the river both for boiler-feed and condenser purposes, and has proved suitable. Some trouble is experienced during the high storm-water period in the summer, as well as in the winter from ice, but these troubles have not been serious. The generating station equipment consists of the following:

3 batteries each of two 225-hp. Heine water-tube boilers provided with Heine superheaters and Babcock & Wilcox chain-grate stokers
2 steam-feed water-pumps
2 steam-feed water-heaters
2 steam-driven stoker-engines
2 1000-kw. Westinghouse-Parsons turbo-generating sets with direct-connected exciters.
5 switchboard-panels
1 outgoing 44,000-volt electric-driven oil-switch
4 400-kva. transformers.
2 electric motor-driven surface-condensers
2 electric motor-driven intake-pumps

The transmission line from the power-house to the Concession is approximately 50 miles long. At Paa Mi Chang, about 34 miles from the power-house, the line divides, one line going 20 miles to Holkol and the other 16 miles to Tul Mi Chung.

The pole-line is constructed of wood and carries three No. 6 wires, with current at 44,000 volts, three-phase, 60 cycles. Sub-stations are situated at Tul Mi Chung and at Soctarie (for Holkol), where the current is stepped down to 440 volts for general use. For operating the air-compressors, the current is transmitted at 2200 volts to the compressor-houses at both mines and there stepped down to 440 volts. The air-compressors are driven by 210-hp. synchronous motors, which serve to balance the line-load.

Two batteries of boilers are sufficient to supply the steam for the operation of one of the turbo-generators and the other battery of boilers is held in reserve. Likewise only one of the turbo-generators is in use, the other being a spare in case of accident or repairs being necessary.

The whole plant is under the charge of experienced Japanese electrical engineers, and it is satisfactory to note that the operating time averages well above 98% full time.

Foundry and Machine-Shops. Owing to the situation of the mine and the distance from any large machine-works, the mills are provided with well-equipped machine-shops and a foundry. Thus the great bulk of all mine and mill repair-work is done on the Concession. Castings up to about one ton are made and all brass-work required is cast on the mine. During the last three years when the effect of war conditions resulted in difficulty and delay in obtaining any machinery parts, and prices for iron and steel in the Japanese works were enormous, the tendency at the mine has been to extend the scope of our own foundry and fitting-shops, which have turned out work at only a fraction of the Japanese cost. As a rule the work done at the mine is much superior to anything that could be purchased in Japan.

Labor Conditions. Although it is generally accepted in mining literature that cheap native labor is not economical, or at all events no more economical than higher-paid white labor, our experience in Korea and North China is that native labor is more economical than white

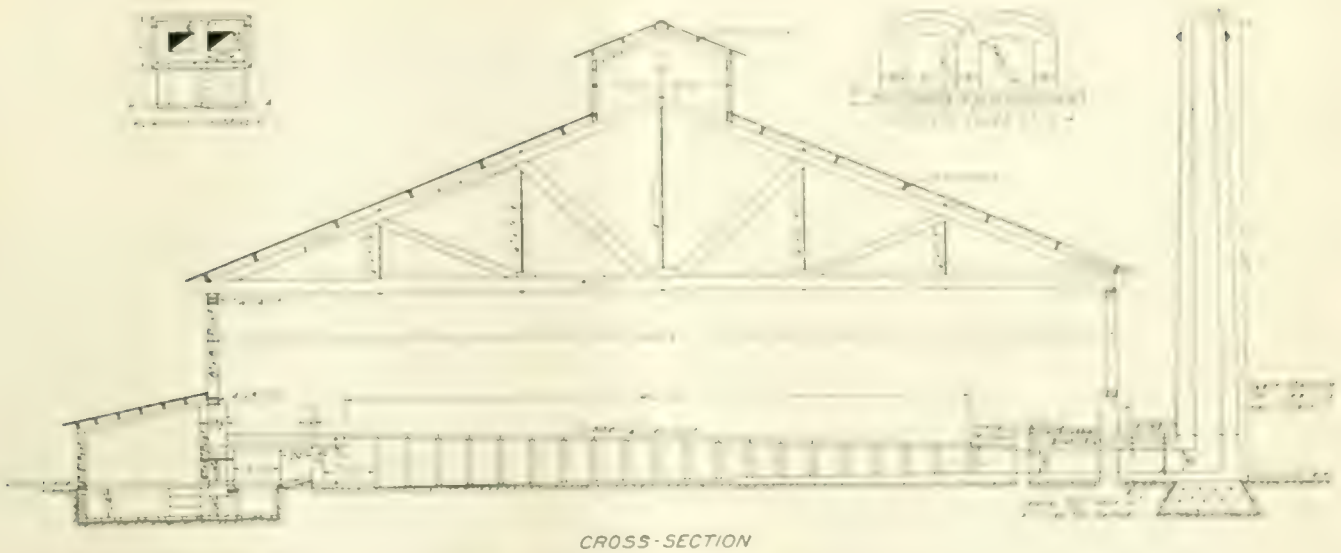
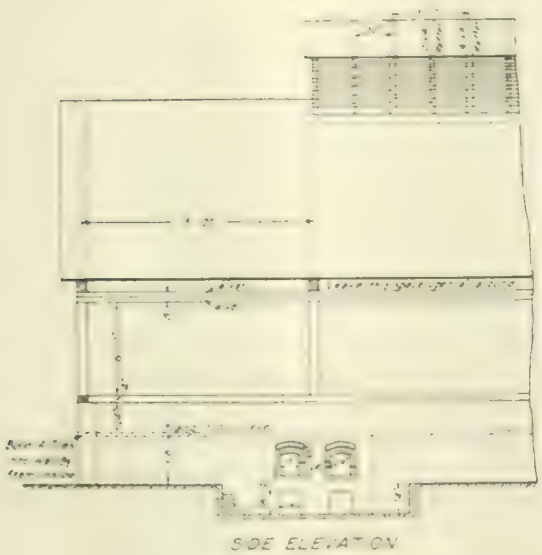


FIG. 4. DRYING-FLOOR IN TUL MI CHI NG MILL.



labor. The outstanding factor of the mining and milling operations is the efficiency and economy of Korean and Chinese laborers, especially as miners, working at low rates of pay, namely, 25 cents per day for miners and 20 cents per day for coolies.

In many of the comparisons that have appeared in technical literature to show the relative efficiency of white and colored labor, the point does not appear to have been emphasized that, as a rule, such comparisons have been based on operating costs and results at mines where a comparatively large staff of white operators is employed for such work as handling explosives, underground timbering, engine-driving, pumping, and hoisting, whereas on the Suan Concession foreigners are only employed in small numbers to supervise work, and Koreans are entrusted with work that in most mines where native labor is employed is done by foreigners. Not only that, but many portions of our mine-workings are in charge of Korean shift-bosses who have proved with us, under proper supervision, as efficient as the average white shift-boss. The mining experience of some of these Korean shift-bosses is extensive and much of it gained in practically every foreign-operated mine in this country. Another point in favor of employing Korean shift-bosses is that it takes a foreign miner at least a year to pick up enough of the language and customs of the Koreans to prove his full usefulness. After a considerable experience in mining in oriental and tropical countries, we are convinced that, leaving out the language trouble, it is much more difficult to obtain men to handle native labor satisfactorily than it is to obtain men to handle white labor. For one thing, where white labor is employed there is, as a rule, ample opportunity to replace unsatisfactory men, while in the case of a mine working in a tropical country and employing colored labor, it is a matter of considerable expense and loss of time to replace an unsatisfactory imported shift-boss. In such cases too the maintenance of foreigners is costly as compared with their maintenance in white countries, and the cost to a mining company of employing a foreigner in, say, Korea, is more than the cost would be for the same man, say, in America. The tendency too of many white men is to fall off in efficiency in tropical and oriental countries. All of these features militate against good results being obtained in mines worked by native labor and have as a rule been put down to the inefficiency of the labor itself.

Our comparison of the relative efficiency of the average foreign shift-boss as compared with a Korean shift-boss, working underground under similar conditions, is largely based on detailed monthly mining cost-sheets prepared to show not only the final cost per ton of ore mined or per foot driven in each working-place in the mine, but also showing the details of the various items making up such a total cost. The stopes or workings entirely in charge of Korean bosses, under the general supervision of a mining foreman or his assistants, as a rule, show as cheap a cost as those in charge of foreign shift-bosses and are as efficiently worked. The Korean is a born miner, and the timbering and operation of some of the stopes on this Concession in difficult ground that are entirely in charge of Korean shift-bosses, with probably one visit per

staff from the mine foreman, would be a credit to any mine.

Besides Koreans, a large number of Chinese, mostly from Shantung in North China, are employed as miners. Probably the main difference between Chinese and Koreans is that while the Korean is a better miner as regards the following of ore and the timbering of workings, the Chinese is a harder worker and will make more money by mining on contract than a Korean, especially when hand-drilling in hard ground.

Both Chinese and Koreans make excellent machine-drill operators, blacksmiths, fitters, etc., and are quite efficient as engine-drivers, hoist-men, pump-men, etc. On the surface most masonry work, bricklaying, etc., is done by Chinese contractors, who as a rule employ Chinese crews. Carpenters are generally Japanese of Chinese.

GENERAL. The number of foreigners, mostly British and Americans, employed on the Concession is 31 and together with their families the whole foreign population on the Concession numbers 60.

Well-equipped hospitals are established at the two main camps under a foreign doctor, whose staff includes several qualified Korean doctors. All medical attention is free to all the employees; likewise a large number of Koreans and Japanese not connected with the company receive free medical attention. The annual cost of maintaining the hospitals and medical staff is $8500 (the cost for 1918 being $8670) and the number of treatments given during the last year was 30,570. The total number of treatments since the first hospital was built in 1909 to the end of 1918 was 203,834. The greatest difficulty the medical staff has to contend with is the absolute lack of sanitation among the Koreans and the indifference of the local authorities in this respect. Thanks to the vigilance of the medical staff, however, the mining camps on the Concession have been remarkably healthy, and, with the exception of a serious outbreak of influenza last year, epidemics have been few and not serious. The most common disease among the Koreans is caused by intestinal parasites, all the native patients examined being found to suffer from this complaint. It is of passing interest to note that Government statistics show that per year the casualties in Korea from attack by tigers, leopards, bears, wolves, and wild pigs were 129 killed and 105 wounded; besides 2839 cattle that were killed and 414 wounded.

At the two main camps clubs with a billiard-table, bowling-alley, and tennis-courts are provided. Living conditions are generally comfortable.

Korea now forms part of the Japanese empire and the local Government officials at the mine are mostly Japanese. Although the Government regulations are somewhat strict and great stress is laid on the carrying out of what appears from a foreign point of view to be unnecessary and at times tiresome details, the relations existing between the company and the local officials have been very satisfactory. There is a Government post and telegraph office at both main camps, and telegrams in English are accepted. All cash required at the mines is brought in through the post-office, which is a convenient arrangement.

The Concession is situated 42½ miles away from the nearest railway connection and transportation forms a somewhat serious item in the operating cost. The roads are not good, especially in the wet season, when traffic is often held up by the bad condition of the roads. Practically all transport is by bull-cart.

The climate is good, although extremes of temperature are great. The winter climate is about similar to that of Denver. In the summer the maximum shade temperature reaches 90°F., and, as the greatest heat is during the rainy season in July and August, it is oppressive. For the larger part of the year, however, the climate is dry and bracing; during spring and autumn it is ideal. The average rainfall is 40 inches, most of it from June to September. The snowfall is light, rarely exceeding six inches.

Manganese in Brazil

The richest mineral zone of Brazil lies in the heart of the Republic, in the State of Minas Geraes. The name Minas betrays both its past traditions and its hopes for the future. Gold, silver, iron, manganese, diamonds, or other precious stones abound in the central and northwestern Provinces. At the present time, however, only a very small portion of the valuable beds of mineral is being worked. Doubtless existing unsatisfactory mining laws, as well as lack of fuel and transportation facilities, are responsible for this condition. Practically the only deposits being exploited at the present time are those of manganese situated near the railway lines. The largest of these is the Mina do Morro, which has played a prominent part in American industrial life during the War, when large quantities of this mineral were required for the manufacture of steel. Over a road ballasted with manganese, the train bearing the visitor climbs to the top of a mountain of manganese, where the actual process of mining the ore is visible. To the novice it appears to be nothing more than the digging or dynamiting off a hillside, crushing the blocks into pieces convenient for handling, and loading these on carts drawn by donkeys, which automatically walk to the dumps with their loads. No underground mining is done. A Brazilian firm owns this mine, which has been ably organized and operated for 17 years under its administration. The total invested capital is approximately $600,000, two-thirds of the stock belonging to the above company. A total of 1,600,000 tons of manganese ore has already been exported in the history of the mine, and it is estimated that there is still in sight a total of about 10,000,000 tons, covering an area of 150 hectares, the average thickness of the manganese deposits being about 200 metres. The ore is 48 to 50% pure, although the percentage runs much higher in some cases. The exportation of 1917 was about 200,000 tons, and in 1918 about 300,000. With the close of the War there was a sharp drop both in the amount exported and in the price received for the ore. In the latter case the drop was about 50%. The labor conditions in connection with this mine are exemplary. In 1916 about 1000 men were employed.

A Calculator for Mine Valuation

By ROSS B. HOFFMANN

I heav read in yeur paper on several occasions dis cussions on the use of various formulæ in the valuation of mines. The one most generally used, I believe, is that upon which the results on pp. 116-121 of 'Inwood's Tables' are based. It may be expressed by the equation

$a = V \times \text{redemption factor} + V\frac{N}{100}$. Equation I

This gives the annuity (or net yield per annum) a, which will yield $N\%$ per annum on the capital V and replace this capital at the end of n years by means of a sinking (redemption) fund accumulating at the rate of $i\%$ per annum.

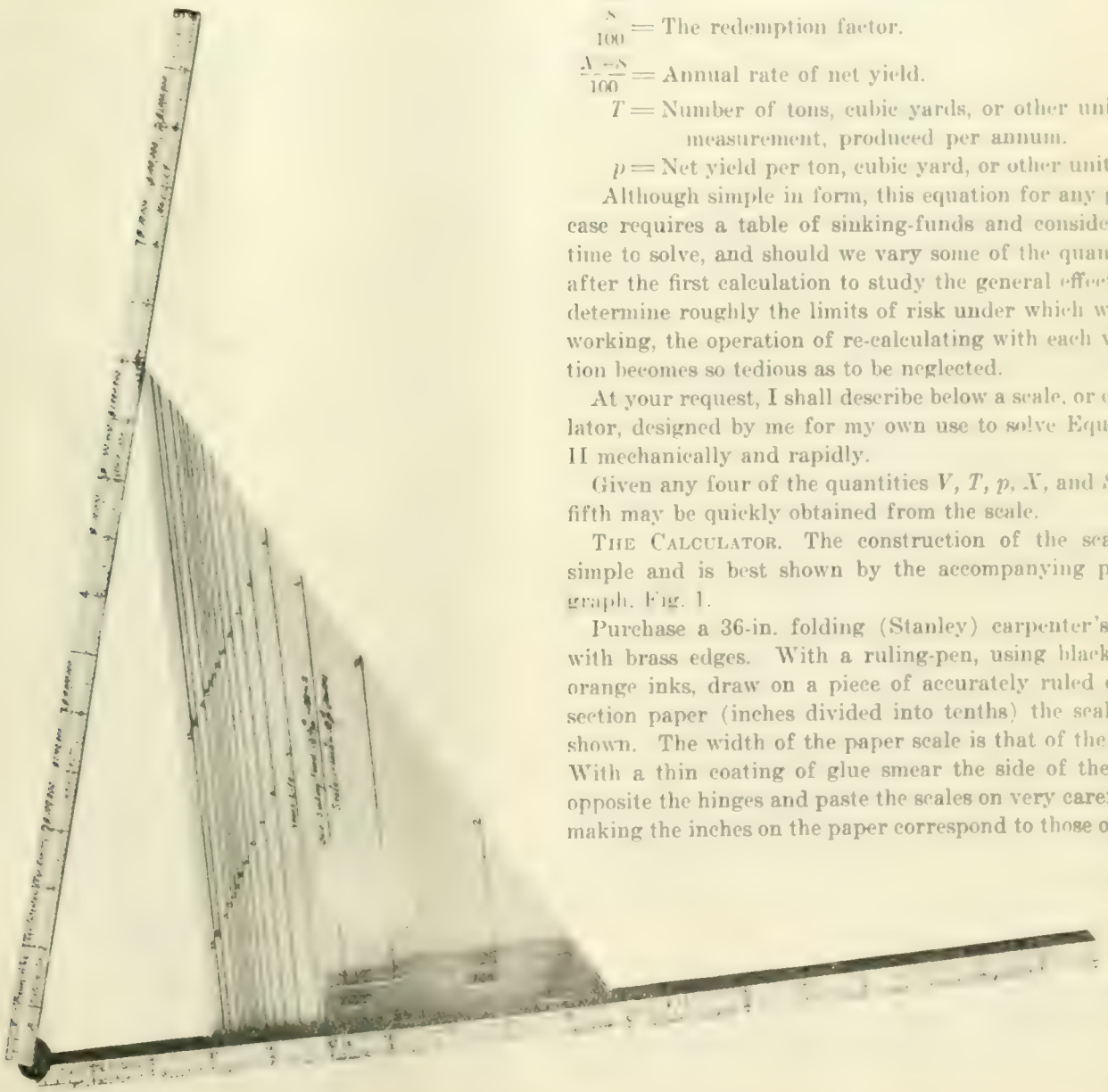


FIG. 1

The 'redemption factor' for any number of years is the number representing the annuity that, with compound interest i, will at the end of the period amount to one unit of V.

When applied to the valuation of mines the equation may be re-written as follows:

$a = Tp - V\frac{N - S}{100}$ Equation II, where

a = Net yield (earning) per annum.

V = Capital expenditure, present value, capitalization.

$\frac{N}{100}$ = Annual rate of interest paid on V.

$\frac{S}{100}$ = The redemption factor.

$\frac{N-S}{100}$ = Annual rate of net yield.

T = Number of tons, cubic yards, or other units of measurement, produced per annum.

p = Net yield per ton, cubic yard, or other unit.

Although simple in form, this equation for any given case requires a table of sinking-funds and considerable time to solve, and should we vary some of the quantities after the first calculation to study the general effect and determine roughly the limits of risk under which we are working, the operation of re-calculating with each variation becomes so tedious as to be neglected.

At your request, I shall describe below a scale, or calculator, designed by me for my own use to solve Equation II mechanically and rapidly.

Given any four of the quantities V, T, p, N, and S, the fifth may be quickly obtained from the scale.

THE CALCULATOR. The construction of the scale is simple and is best shown by the accompanying photograph, Fig. 1.

Purchase a 36-in. folding (Stanley) carpenter's rule with brass edges. With a ruling-pen, using black and orange inks, draw on a piece of accurately ruled cross-section paper (inches divided into tenths) the scales as shown. The width of the paper scale is that of the rule. With a thin coating of glue smear the side of the rule opposite the hinges and paste the scales on very carefully, making the inches on the paper correspond to those on the

rule. The zero of the scale is the centre of the circular hinge-joint of the rule.

Do not put glue on the paper scale, as it will stretch. It will also stretch if the glue is too thin and too thickly spread; slight inaccuracies in the calculations would thus be introduced. Cut the paper at the joints of the rule before closing.

Purchase a 20° or 30° right-angle celluloid triangle with the longest side 15 in. or more in length. With an architect's scale and a needle-point, lay off accurately for various numbers of years distances from this edge equal to S or 100 times the redemption factor. (See Inwood's, or any other standard, interest tables.) For convenience, these distances are tabulated below. The scale of measurement should be 1 inch = 10 units, the same as for the $X + S$ scale on the rule. The redemption factor may be chosen for any rate of interest desired; 4% is used below.

Number of years	Corresponding value of S	Number of years	Corresponding value of S
2	49.02	11	7.41
3	32.03	12	6.65
4	23.55	13	6.01
5	18.46	15	4.99
6	15.08	20	3.36
7	12.66	25	2.40
8	10.85	30	1.78
9	9.45	50	0.65
10	8.33		

Next scratch lines by means of a sharp penknife and straight-edge through these points, parallel to the vertical edge of the triangle (on the under side when in the position shown in Fig. 1) and print upon each line the number of years represented thereby.

Fasten a cleat as shown on the triangle to hold it in place when in use. An ordinary paper-punch will make the holes through the celluloid, and paper-fasteners may be used for binding on the cleat.

Having completed the above, which any good draftsman should be able to do in a few hours, the calculator is ready for use.

Theory and Use. For convenience in construction of the scales Equation II was re-written as follows:

$$\frac{10\,T}{V} = \frac{(X+S)}{10\,p}\cos j$$ (j is the angle between the arms of the calculator). Equation III.

The scales fixed upon the movable arms of the calculator are based on Equation III. All readings are taken at the radial edges of the movable arms.

For convenience in constructing the scales of the calculator, the unit of length for measurement of T and V was taken very different from the common unit of length for the measurement of X, S, and p. This does not destroy the relation expressed by Equation III, as is readily seen from the form of the equation.

For convenience also in the use of the calculator, the number representing the tonnage (or yardage) T is placed at the point on the scale representing in reality $10T$, and the number representing the net yield p per ton (or cubic yard) is placed at the point on the scale representing in reality $10p$.

If the cosine of the angle j between the movable arms be therefore set by the apparent relation $\frac{T}{V}$ or $\frac{X+S}{p}$ as read from the scales, the relation is in fact as shown in Equation III: $\frac{10\,T}{V}$ and $\frac{X+S}{10\,p}$. To set the angle whose cosine is $\frac{10\,T}{V}$ or $\frac{X+S}{10\,p}$ therefore, proceed in one of two ways:

1. Place the point on the radial edge of the upper arm of the calculator representing V vertically over the point on the radial edge of the lower arm marked with the annual tonnage (or yardage) T. The two scales involved here are ruled in orange.

2. Place in the same manner the point marked with the net yield per ton p vertically over that representing $(X + S)$. The two scales involved here are ruled in black to readily distinguish them from the others.

In any problem that might arise, the angle j is set by the use of one or the other pair of scales, as above described.

The placing of one point vertically above another as required above is accomplished by use of the celluloid triangle, which is made to slide on the radial edge of the lower arm of the calculator, its vertical edge, or any one of the parallel lines thereon, determining the required positions of the points.

As previously noted, the value of S for any given or assumed life is represented on the sliding triangle by the distance from its vertical edge to the vertical line upon which is printed the number representing this life. The unit of measurement being the same as that for the $(X + S)$ scale it follows that if we read $(X + S)$ with one of the vertical lines representing a definite life, then the vertical edge of the triangle gives the reading $(X + S) - S$ or X. Thus the per cent annual interest X may when desired be read directly from the $(X + S)$ scale.

The scales of the calculator having been once fixed on the movable arms, the quantities represented by the units thereof may be varied for convenience in working the great range of problems that fall within its scope, so long as these changes do not destroy the relations of Equation III. In order, however, that we may in all cases make use of the S scale, which is permanently scratched on the triangle, it is necessary that the unit of this scale be always the same as that of the $(X + S)$ scale and that the latter therefore be not changed.

Below are given in tabular form several groups of values for the units of the T and V scales corresponding to unit of $(X + S)$ scale (remaining unchanged) = 1% and unit of p scale equal $1, 10 cents, and 1 cent respectively. The values for each group should be printed clearly on the scales in columnar form and correspond in such a way that when the values of the units in any one column are used simultaneously the relations of Equation III are not destroyed (see Fig. 2). Each scale is graduated on the decimal system.

If we take the net yield per ton (or cubic yard) expected as an index, whether in dollars, tens of cents, or

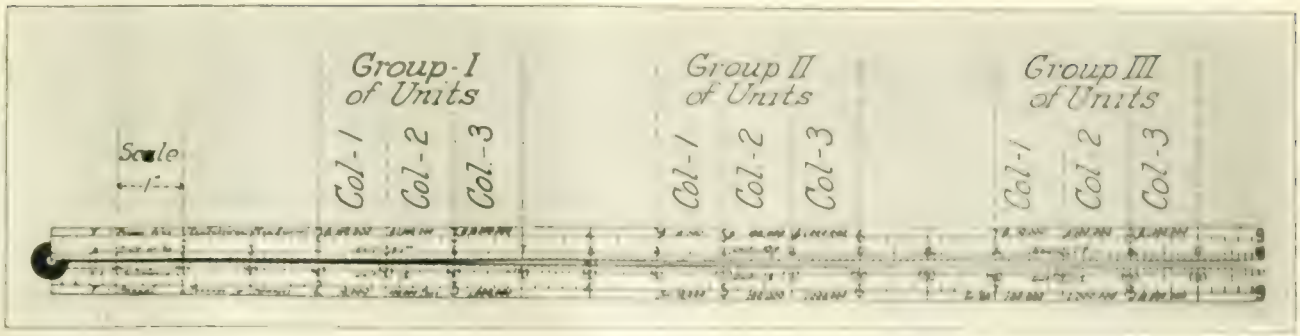


FIG. 2

cents, the corresponding group of unit-values may be chosen quickly and the proper column selected to meet the requirements of the particular problem.

1 unit of V and S on the scale = 1 inch
" " " p " " " = 1 inch
" " " V " " " = 2 inches
" " " T " " " = 2 inches

The groups of units are as follows:

Group I of Units

		Column 1	Column 2	Column 3
When the unit of	p =	$1	$1	$1
And the unit of	X = S =	1%	1%	1%
Then for the unit of	T =	10,000*	100,000*	1,000,000*
The corresponding unit of	V =	$100,000	$1,000,000	$10,000,000

Group II of Units

		Column 1	Column 2	Column 3
When the unit of	p =	10c.	10c.	10c.
And the unit of	X = S =	1%	1%	1%
Then for the unit of	T =	10,000*	100,000*	1,000,000*
The corresponding unit of	V =	$10,000	$100,000	$1,000,000

Group III of Units

		Column 1	Column 2	Column 3
When the unit of	p =	1c.	1c.	1c.
And the unit of	X = S =	1%	1%	1%
Then for the unit of	T =	100,000*	1,000,000*	10,000,000*
The corresponding unit of	V =	$10,000	$100,000	$1,000,000

*Tons or cubic yards.

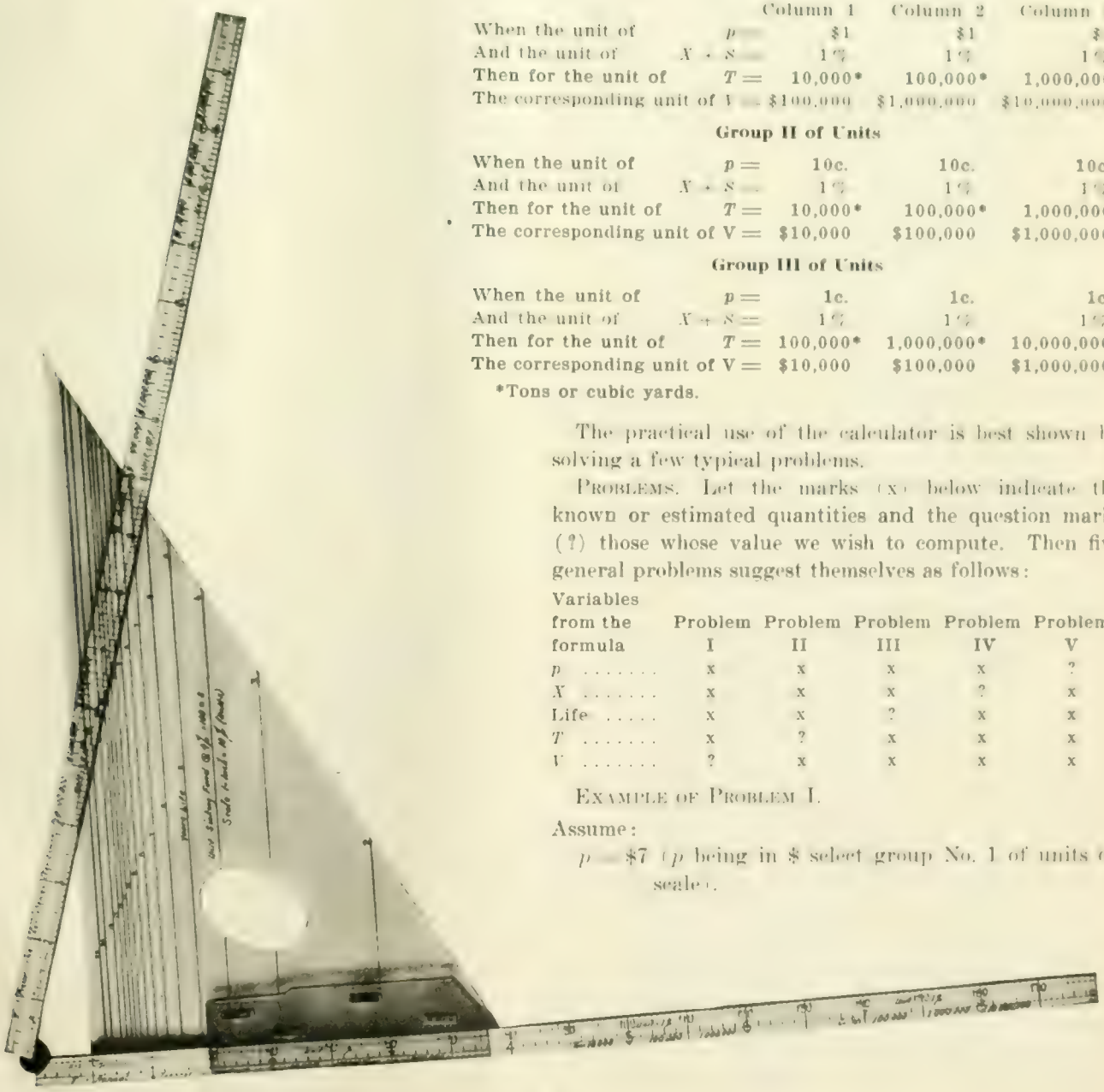


FIG. 3

The practical use of the calculator is best shown by solving a few typical problems.

PROBLEMS. Let the marks (x) below indicate the known or estimated quantities and the question marks (?) those whose value we wish to compute. Then five general problems suggest themselves as follows:

Variables from the formula	Problem I	Problem II	Problem III	Problem IV	Problem V
p	x	x	x	x	?
X	x	x	x	?	x
Life	x	x	?	x	x
T	x	?	x	x	x
V	?	x	x	x	x

EXAMPLE OF PROBLEM I.

Assume:

p = $7 ($p$ being in $ select group No. 1 of units on scale).

$X = 10\%$.
Life = 10 years.
T = 150,000 tons per annum (T being in hundreds of thousands, select column 2 of units).

Required V.

Set the angle j between the movable arms by placing the point $X = S$ vertically under p, that is, with the vertical edge of the sliding triangle set at 10%, move the upper arm of the calculator until the 10 years life-line on the triangle passes through the point marked \$7 on this arm (see Fig 3). Next slide the triangle so that its edge marks 150,000 tons. The point vertically above this on the Present Value scale will be the required result, namely, \$5,730,000 (see Fig. 1).

For examples of Problems II, III, IV, and V, we may take any values for the known or estimated quantities and therefrom calculate the required results, but to illustrate the successive steps would require more photographs, such as represented by Fig. 1 and 3. We shall therefore use the same values as assumed or found in Problem I. The photographs will then suffice to show the successive steps in the use of the calculator and indicate for each problem the value of the required unknown quantity.

EXAMPLE OF PROBLEM II:

Set the angle as in Problem I. See Fig. 3.
Next slide the triangle so that its vertical edge marks the value \$5,730,000 for V.
The point vertically under this on the T scale is the required result, namely 150,000 tons. See Fig. 1.

EXAMPLE OF PROBLEM III:

Set the angle j by placing the given T (150,000 tons) vertically below the given V (5,730,000). See Fig. 1.
Next slide the triangle so that its vertical edge marks the given 10%. See Fig. 3.
The required life is that whose line passes through the given p (\$7), namely, the 10-year life-line.

EXAMPLE OF PROBLEM IV:

Set the angle j as in Problem III. See Fig. 1.
Next slide the triangle so that the known 10-year life-line passes through the given p (\$7).
The vertical edge of the triangle marks the required per cent X, namely, 10%. See Fig. 3.

EXAMPLE OF PROBLEM V:

Set the angle as in Problem III. See Fig. 1.
Next slide the triangle so that its vertical edge marks the given 10%.
The required p is that through which the given 10-year life-line passes, namely, \$7. See Fig. 3.

To illustrate further the value of the calculator in the analysis and study of any given problem, revert to the conditions of Problem I. We shall assume that after a careful examination of a mining property the engineer has estimated T (150,000 tons per annum) on which the property shall be worked, its corresponding life (10 years), the net yield per ton \$7, and having taken $X = 10\%$ he has calculated V (\$5,730,000). The calculator would then be in the position of Fig. 1.

Without changing the angle j, we may now slide the triangle to the position such that the 10-year life-line cuts through the point on the scale representing \$5, instead of \$7. The edge of the triangle would show the corresponding value of X to be 4.8%. In other words, if V were fixed at \$5,730,000 and the actual working of the property should prove $p = \$5$ instead of \$7, as estimated, the venture as a whole, although not disastrous, would not have been very profitable. If, in addition, however, the life should prove only 7 years, instead of 10 years, then by sliding the triangle so that its 7 years life-line passes through the \$5 point, the corresponding percentage X would be only a small fraction of 1%, which would show a condition disastrous to the investor.

The engineer, after considering all the evidence and facts and weighing all possible risks, may have decided at the outset that the probable values for p, T, and the life of the mine would be as stated in Problem I; that under very unfavorable conditions the value of p might fall to \$5, and that the minimum estimate for life would be 7 years, and that assuming these most unfavorable possibilities to materialize he would require at least 6% per annum interest on V with the return of V at the end of 7 years. Then, assuming these unfavorable conditions, we set the angle j of the calculator using $X = 6\%$, life = 7 years, and net yield per ton \$5, and find vertically over the 150,000 annual tonnage the present value, or allowable capitalization \$4,020,000.

Taking this value for V and 150,000 for T and assuming that upon working the property not the minimum values, but the estimated probable values for p and the life should prove correct, then without changing the angle j of the calculator, we slide the triangle to the position corresponding to $p = \$7$ and life = 10 years, and read X = 17.8%.

In the original problem then, if X were put at 17.8% instead of 10%, the corresponding value of V would be \$4,020,000 instead of \$5,730,000, and the investor would receive somewhere between 6% and 17.8% on his money V, with the return of V at the end of the life of the mine, so long as the values of p and of the life do not fall below the minimums nor above the 'probable values' estimated. Such an investment might be considered reasonably safe.

The above calculations constitute ten separate problems. The time required with the calculator to solve all ten should not be over 10 minutes. The units used were those of Group I, column 2.

As a further example in the use of the calculator, assume a dredging proposition:

Cost of 7-ft. dredge, property, etc., say, \$350,000 = V.
Cubic yards of gravel per annum, 1,000,000 = T.
Net yield per cubic yard, 7c. = p.
Life, 10 years.
Required per cent annual interest, X.

Solution: The net yield being in cents per cubic yard and the output in millions of cubic yards, select the units of Group III, column 2.

Set the angle j by placing the given I 1,000,000 on j vertically under the given V 1,160,000.

Next slide the triangle so that the 10-year life-line passes through the point marked 7 cents and read at the vertical edge of the triangle the value of X, namely, 11.7%.

Next assume a coal property:

Tons per annum, 1,500,000.
Life, 25 years.
Profit per ton, 0.70.
X (assumed), 15%.
Required V (present value).

Solution: The profit being in tens of cents and the output in millions of tons, select the units of Group II, column 3.

Set the angle j by placing the given profit $0.70 vertically over the point corresponding to 15% and 25 years life. Next slide the triangle so that its vertical edge marks 1,500,000 tons and read on the scale vertically above the corresponding value V, namely, $6,030,000.

Many other forms of problems present themselves, all of which may with a little practice be readily and quickly solved on the calculator.

The calculator in the form shown in Fig. 1 and 3 is crude. If constructed by an instrument-maker equipped with proper machinery, the scales could be easily halved, making the length of arms 10 inches instead of 18 (they should properly be 20) and the triangle could be replaced by a better form of sliding scale.

WORK on the topographic and geologic atlases of the country is carried along by the U. S. Geological Survey as rapidly as means are provided for the field work and for preparing and printing the maps. The Survey's geologic map work is of two kinds, one consisting of special surveys and researches directed to immediate economic results—such as explorations for new oilfields or examinations in mining districts—the other consisting of systematic geologic mapping of the country by rectangular areas called quadrangles, the geology of a quadrangle or a group of adjacent quadrangles being made the subject of a geologic folio. Over 200 geologic folios have now been published, and the latest to appear (Folio 209) is one covering the Newell quadrangle, named from the town of Newell, in western South Dakota. The southeast corner of the area mapped is crossed by Belle Fourche river. The folio describes the geography and geology of the area and its economic resources, including underground water. It contains a topographic and a geologic map and a map showing areas in which flowing artesian water may be obtained at depths that are indicated. A sheet of halftone views shows some characteristic features of the country, among them what are called teepee buttes, steep-sided conical buttes 100 ft. or more high. This folio may be obtained for 25 cents on application to the Director of the U. S. Geological Survey, Washington, D. C.

Cost of Copper Production

A forward step toward the standardization of copper production costs was taken during the Government's war-time control of the metal prices, although the methods adopted at that time were not in strict accord with the general ideas of mining companies' managements. It was ascertained, as a result of this standardization, that the average cost of 85 companies for the year 1918 was 16.167c. per pound. The range extended from below 12c., where two companies turned out over 122,000,000 lb. jointly, to over 34c., above which level five small concerns produced approximately 7,000,000 lb. Several small Michigan companies, which came into being during the regime of high prices, were the highest cost properties, as five of them, contributing in all 6,975,960 lb., had an average cost of 34.614c. per pound, thereby showing a big loss from the fixed prices of 23½ and 26c. The largest companies as a rule were the cheapest producers. The average of the porphyry group for 1918 was 14.886 cents.

The allocation of production of copper in 1918 according to cost per pound may be found in the following compilation of the Federal Trade Commission:

Range of cost		Number of companies	Production, lb.	Per cent
Cost less than 12 cents		2	122,000,000	24
Cost between 12 and 13 cents		4	108,000,000	21
13	14	4	84,000,000	16
14	15	4	60,000,000	12
15	16	5	38,000,000	7
16	17	8	16,000,000	3
17	18	9	12,000,000	2
18	19	3	7,000,000	1
19	20	4	8,000,000	2
20	21	6	16,000,000	3
21	22	9	12,000,000	2
22	23	2	6,000,000	1
23	24	1	4,000,000	1
24	25	1	6,000,000	1
25	26	1	4,000,000	1
Cost over 26 cents		18	16,000,000	3
Total, 85 companies		85	512,000,000	100

The above figures include companies that buy and sell ores, so that there is a duplication of 63,700,000 pounds.

Up to the year 1917, few companies reported depletion as a cost; whereas practically all companies now include such a charge, based on the re-valuation of their mineral land. This is one of the largest single factors accounting for the increase in the cost of producing copper in the last year or two. Depreciation appeared on the books of mining companies at about the same time as depletion and for the same reason. Unfortunately, the rates are not based on the life and residual value of particular assets, but are more often arbitrary amounts based sometimes on what will be allowed as deductions on tax reports and sometimes on the best judgment and opinion of officers or directors.

The commission has not attempted to equalize depreciation for the various companies, usually accepting the depreciation charges as made by the company. In some instances, however, the cost of shafts, tunnels, openings, and underground equipment charged to cost in prior years has been set up on the books and depreciation again charged into cost. The commission did not allow depreciation of this nature, the amounts in any case being but small.

Mineral Production in British Columbia

STAFF CORRESPONDENCE

One of the mining engineers in the service of the Provincial government, in commenting on the progress of the mining industry in British Columbia during 1919, observed that from the viewpoint of production, it was a period of 'marking time', but, if looked at with an eye to the future, it had been one of the most eventful and encouraging twelvemonths in the history of the Canadian North-West.

This rather accurately sums up the situation. From figures available from the various producing properties, there can be no question of a distinct shrinkage in the output of most of the chief economic metals. It is possible that the estimates made of the production from the last date on which authentic statistics were to be obtained to the end of the year, will be proved at fault. Consequently it is possible that final information will indicate some increase in the present estimates of the production of gold, silver, copper, and lead.

The world's market conditions as compared with those of the previous year have been, of course, responsible, in a large degree, for the 1919 results. These, however, were augmented by local occurrences which retarded production. The Phoenix copper mines and the Grand Forks smelter were closed entirely by the Granby Consolidated Mining & Smelting Co. some months ago. To this may be added that the same company, the largest copper producer of the Province, owing to labor troubles and for other reasons, is estimated to have turned out nearly 10,000,000 lb. less at its Anyox plant. When the War ended the Consolidated Mining & Smelting Co. had a surplus of lead so that it is not surprising that a material drop in the quantity of the output is indicated. There is some satisfaction, under the circumstances, in being able to show that the East and West Kootenays, evidently, have passed the 1918 mark, substantially, in regard to the zinc output. It is to be noted, however, that the Sullivan Mines Co., the greatest single zinc producer of the Province, still is limping along as the result of a strike of its miners.

With reference to the precious metals, while the future outlook is bright as to silver due to the opening of the Salmon River section of the Portland Canal district, where the Premier mine is situated, the returns thus far received do not reflect the general revival of interest in all properties producing this metal. The chief cause of this is found in the situation in the Slocan mining division, where the Standard, to instance one of several properties, has ceased shipping silver ore. The withdrawal of this large producer, and of others of the area, from the actively producing class has not been neutralized by the contributions of the new northern section, or by those of scattered but numerous small shippers. Many of these are starting in a small way throughout all the mining districts, the incentive, of course, being the high price of silver. The handicap confronting those engaged in gold production elsewhere, applies with equal force in British Columbia, although, notwithstanding high costs, more placer ground is being taken up in the Cariboo and in little-prospected parts of the far north, and there is lode mine development under way of a promising nature in several districts.

Obviosuly 1919 has not been a record breaker as to production. It has, however, been exceptional in the interest displayed in mining; in the development that has been initiated with splendid results; in the discovery of a new mineralized zone having good possibilities; and in the encouragement which the year's achievements have given all interested in the industry. The fact that the production seems to have dropped is forgotten in contemplation of the sure foundation that is being laid for the future.

Following is a comparison of the production, from the six districts of the Province, for the years 1918 and 1919, figures for the latter year being estimates of the Government's district engineers.

No. 1—Comprising the divisions of Bella Coola, Queen Charlotte, Skeena, Portland Canal, Naas River, Atlin, Stikine, and Liard. George A. Clothier, engineer

	1918	1919	Comparison
Gold (placer) Atlin and Liard divisions	$219,000	$189,000	$30,000†
Gold (lode) ounces	17,993	59,729	11,736*
Silver ounces	415,280	905,685	490,405*
Copper pounds	30,198,782	20,670,685	9,528,097†

No. 2—Comprising the divisions of Omineca, Quesnel, Cariboo, and Peace River. J. D. Galloway, engineer

	1918	1919	Comparison
Gold ounces	5,385	5,700	315*
Silver ounces	81,125	90,000	5,875*
Lead pounds	123,568	100,000	23,568†
Copper pounds	643,843	12,000	631,843†
Zinc pounds	313,112	300,000	13,112†

No. 3—Comprising divisions of Clinton, Lillooet, Kamloops, Ashcroft, Nicola, Vernon, and Yale. R. W. Thomson, engineer

	1918	1919	Comparison
Gold ounces	3,288	3,200	88†
Silver ounces	negligible	6,600	6,600*
Copper, pounds	531,000	520,000	11,000†
Magnesium sulphate, tons	150	650	500*

No. 4—Comprising divisions of Grand Forks, Osoyoos, Greenwood, and Similkameen. P. B. Freeland, engineer

	1918	1919	Comparison
Gold ounces	53,654	33,000	20,654†
Silver ounces	227,244	203,000	24,244†
Copper, pounds	9,940,125	3,990,000	5,950,125†
Lead pounds	17,738	31,500	13,238†
Fluorite tons	170	650	480*
Limestone tons	2,000	16,300	14,300*

No. 5—Comprising the divisions of Golden, Windermere, Fort Steele, Revelstoke, Lardeau, Ainsworth, Slocan, Slocan City, Trout Lake, Nelson, Arrow Lake, and Trail Creek, generally referred to as the East and West Kootenays. A. G. Langley, engineer

	1918	1919	Comparison
Gold ounces	51,020	35,771	15,249†
Silver ounces	2,650,918	1,945,982	704,936†
Lead pounds	43,728,355	17,669,970	26,058,385†
Copper pounds	1,685,299	1,354,130	331,169†
Zinc, pounds	41,450,804	43,340,700	889,896*

No. 6—Comprising the divisions of Alberni, Clayoquot, Quatsino, Nanaimo, Victoria, Vancouver, and New Westminster

	1918	1919	Comparison
Gold ounces	5,465	3,200	2,265†
Silver ounces	116,425	110,000	6,425†
Copper pounds	18,475,013	20,000,000	1,524,987*

Grand Total for Province

	1918	1919	Comparison
Gold ounces	180,674	150,050	30,624†
Silver ounces	3,498,172	3,261,267	236,905†
Copper pounds	61,483,754	46,516,815	14,936,939†
Lead pounds	43,899,661	17,801,470	26,095,191†
Zinc pounds	41,772,916	43,640,700	1,867,784*

*Indicates increase †Indicates decrease

REVIEW OF MINING

FROM OUR OWN CORRESPONDENTS IN THE FIELD

ARIZONA

UNITED VERDE TO MINE "BURNING" STOPES—SMELTER CAPACITY INCREASED.

COURTLAND.—The Leadville Mining Co., of which William Holmes is manager, has discovered excellent ore on the 300-ft. level of its No. 2 shaft. The body was encountered 300 ft. from the main shaft about a month ago, but nothing was said by the management until it could be explored. When two parallel drifts 50 ft. apart had been driven into the orebody for a distance of 80 ft. without striking the hanging wall, Mr. Holmes announced the discovery to stockholders. He also said that the company would be able to pay its first dividend shortly after January 1. This discovery at the Leadville, coupled with the recent announcement of favorable development by the Great Western company, has caused confidence in the future of the camp. Ten years ago there was an historic rush to Courtland, but when public utilities had been established and all preparations for a large camp made, the boom died. The C. & A. company has twice done considerable work on it under bond.

GLOBE.—The Gibson company is producing about 11 tons of concentrate per day in its new mill. Much of the work is done by Apache Indians. The Superior & Boston company has chosen as directors Garrett Mott, J. B. Hardon, W. F. Fitzgerald, J. F. Barry, and T. R. Drummond. Officers will be elected at a board meeting in Boston. Shipments are being made from a copper vein 4 ft. wide on the 400-ft. level, containing 24% copper and 92 oz. silver per ton. Drifting is being done on the vein in both directions. The company is drilling below the 1200-ft. level to pick up extensions of known orebodies. Diamond-drilling is to be started soon on the Louis d'Or property north of Inspiration. A mill is planned. A New York company is operating the Princess Pat property in Graham county, 18 miles south-east of San Carlos. The mine is under bond from G. M. Allison of Stanley, and O. W. and J. S. Allison of Globe.

JEROME.—The United Verde Copper Co. has started its long planned attack upon the old burning sulphide stopes which have been smoldering for more than 20 years and have defied all efforts to extinguish them. The plan is to use enormous steam-shovels to remove the ready-made calcines which will be hauled in steel hopper, broad-gauge cars, and dumped direct into the reverberatories at the company smelter at Clarkdale. The shovels already are at work excavating for the new mine power-plant and surface buildings; 14,000,000 cu. yd. of material will be gouged out of the face of the Black Hills range. All waste will be used to fill ravines. A winding railroad has been built on a 4% grade up the mountain. This road has been under construction for two and a half years and in addition to serving the mine will serve the people of Jerome. At Clarkdale the United Verde smelter has already doubled its capacity, though the improvements are not yet complete. Former Senator W. A. Clark realizes that no increase in present production is wanted, but he foresees a great demand for copper. Six reverberatory furnaces of larger type than those now in use have been added. Twelve new roasters, of greater capacity than the old ones, have been built. Other improvements include installation of two Great Falls converter stands and eight new Sterling boilers. Two special features worthy of mention are the use of powdered coal as fuel for reverberatories in place of fuel oil, which of late has proved very expensive. Gallup semi-bituminous coal is stored under water until needed, as it is quite susceptible to spontaneous combustion. Before using it is crushed, dried, and then pulverized until it can be sifted through a 100-mesh screen. It is then ready to be taken by air-blast and blown into the 100-ft. reverberatories. A smoke-treating plant operated under 125,000 volts catches and deposits all metal particles. The smoke-treating plant will cost $75,000, but great results are anticipated from it.

CALIFORNIA

NEVADA COUNTY NOTES

NEVADA COUNTY.—The Red Ledge mine at Washington, famous as a producer of specimen quartz and leaf gold, owned by Bruce and Foster Williamson and Clyde Cole, has been bonded to P. R. Kelsey of Quincy, Plumas county. Operations have already commenced under the management of Lewis Hind. The bonded price has not been made public. The property embraces several claims but no development work has heretofore been attempted. The Grass Valley Chamber of Commerce has placed its mineral cabinet in the lobby of the Bret Harte hotel, considering that place the most advantageous for display purposes. An appeal has been made to the mining public for more specimens of ores either as gifts or loans. The mineral rights under the property of Mrs. B. K. Wood have been sold to the Empire Mines & Investment Co. A probable offshoot of the Woodville vein has been encountered by the Boundary Gold Mines Co. after sink-

ing for several months. This presumed offshoot, though narrow, shows free gold in abundance. The company owns nearly 40 acres in which are included the Woodville, Gamblers, Cabin Flat, Upper Scadden, and part of the Peabody claims. There is a theory among the old-timers that deeper workings in the main shaft might solve the mystery of the continuation of the Gold Hill mine gouge, which at a depth of 350 ft. produced some $7,500,000. No trace of a continuation of the vein has yet been found, although large sums have been expended in a persistent search in adjoining mines.

COLORADO

PROFIT FOR UNITED GOLD MINES CO.—DEVELOPMENTS AT CRESSON MINE.

CRIPPLE CREEK.—With their lease expiring on December 31, Anderson and Benkelman, lessees operating the Trail mine, through the Dexter shaft, on the southern slope of Bull hill, are producing at a rate never before witnessed from a Cripple Creek lease. In 11 days in December, 18 cars of ore were shipped to the Golden Cycle mill at Colorado Springs, and settlement netted the lessees $24,965. The United Gold Mines Co. was paid in royalties $8788 and 1% was further deducted in taxes, making the total value of the 18 cars $34,500. The lease, it is understood, will not be extended and the property, controlled by A. E. Carlton, will be operated on company account. The United Gold Mines Co. will pay a dividend of 1c. per share on January 15, to stockholders of record of December 31, and with a substantial treasury reserve it is expected the company will go on a quarterly dividend-paying basis. All of the interested parties in the lease have taken out fortunes and at a rough estimate the lease has cleared $1,000,000. The property adjoins the Cresson mine and the company for some months has been operating from the 1000-ft. level of the Cresson, and is reported to have opened good ore.

Ore-reserves of the Cresson mine are estimated by Charles Noble, consulting engineer, at $1,934,158. Cash in bank is $219,000, with ore in transit and at the mill with an estimated value of $70,000 exclusive of December shipments. The report of A. L. Bloomfield, general manager, shows that during the past fiscal year 19 diamond-drill holes totalling 3667 ft. were drilled. Good ore was disclosed which, according to the general manager, "may result in the discovery of a continuation of the ore" under Stope 1203.

The new orebody opened upon the Buena Vista vein, on the Cheyenne claim, Isabella Mines Co., by the Wilson lease has developed into a strong shoot and two cars of the ore shipped assayed more than 2 oz. gold.

At the annual meeting of the Free Coinage company, held this week, J. B. Neville was elected president and treasurer; A. L. Neville, vice-president and secretary; and A. V. Hunter, director. The company's estate adjoins the Isabella group on Bull hill and is being operated under lease. Production from the Free Coinage group, mined above the 750-ft. level, has been in excess of $2,000,000.

LEADVILLE.—Operations have been resumed at the 'A. V.' mine, after a shut-down of about six months, by M. L. Buchanan and others. The property, located at the head of Harrison avenue, is a producer of manganese ore.

Work on the Canterbury Hill tunnel project will, it is expected, be started in earnest the first of the new year. A small force has already been employed making necessary repairs. Leases have been secured on properties to be traversed by a tunnel which will explore the south end of Prospect mountain.

George Creamer and associates, operating the Hagerman shaft on the Carbonate mine, and adjacent ground owned by the Stars Mines Co., are mining a good grade of ore from their lease and will shortly start shipping.

Smelting ore is being shipped by Cortellini and Zadra from the Blain shaft on Pryor hill. The ore is a high-grade carbonate treated at the Leadville smelter of the A. S. & R. Co.

MICHIGAN

NEW DEVELOPMENT AT THE MAYFLOWER.—CALUMET & HECLA OUTPUT.

HOUGHTON.—The most interesting development in this district is that at the Mayflower-Old Colony property. Following a program laid out some years ago the shaft on December 11 cut into an amygdaloidal formation containing copper, at a point 1670 ft. from the surface. Possibilities warrant lateral opening, after which the shaft will be continued. On account of the fact that it is so far east and so close to the sandstone the Mayflower has been considered as lying outside of the ore-zone. It is, of course, too early to even conclude that the work is going to result in another paying copper mine in the Lake Superior region, but the whole Michigan district is watching the results with interest. The shaft, as well as the drill cores, proves that the entire area has been badly shattered and that the veins have to a large extent flattened out.

After a month of waiting the Seneca company finally has been given a rate for railway transportation so that it may carry its copper ore from the mine dump to the Baltic mill and shipments have been commenced. It is believed that the ore will produce 40 lb. refined copper per ton, or about twice the quantity in the ore from the Mohawk and Ahmeek shafts.

The total output of the Calumet & Hecla company and all its subsidiaries for the present year is estimated at 102,500,000 lb. of copper. The actual production of the Calumet & Hecla group for the first 11 months was 92,981,722 lb. The total for November was 9,498,756. From these figures it is certain that the net output for the whole Lake Superior district will be the lowest in 30 years, not even excepting the production of 1913 and 1914 when the strike made a great difference. The November production from the Calumet & Hecla properties follows: Ahmeek, 1,604,600 lb.; Allouez, 328,100; Calumet & Hecla, 5,056,926; Centennial, 101,000; Isle Royale, 1,260,573; Osceola Consolidated, 904,714; and White Pine, 242,843 pounds.

MONTANA

ANACONDA COMPANY RESUMES

BUTTE.—The copper mines of the Anaconda Copper Mining Co. and the North Butte Mining Co. resumed work on Monday, December 22, after a shut-down of four weeks due to the coal strike. About 7000 men were given work by the re-opening of these properties. The Anaconda company also resumed operations on December 20 at their zinc-silver producing mines, the Emma and the Nettie. These mines have been shut-down since February when a general curtailment in the Butte mining district was put into effect. The ore produced will be shipped to the Great Falls smelter, which was recently opened after a shut-down of 8 months.

T. A. Rickard W. J. Loring Albert Burch

AT THE PLYMOUTH MINE, AMADOR COUNTY, CALIFORNIA

The North Butte Mining Co. is still pursuing active development from the Sarsfield shaft on their east side properties. They are also pushing clean-up and development operations at the Birtha shaft. This shaft, situated in the copper silicate and carbonate zone just north of the Butte and Bullwhacker mine, has been re-timbered to the 90-ft. level. An air-compressor and air-hoist have been put in and a 100-ton ore-bin is under construction. The road to the mine will be put in shape and it is expected that the property will be making regular shipments to the leaching plant at Anaconda by spring.

It is reported, although not officially confirmed, that two new orebodies have just been cut in the Colorado mine of the Davis-Daly Copper Co. On the 2100-ft. level a vein 6 ft. wide and said to assay 8% copper has been opened and another copper vein is being opened on the 2700-ft. level. This property is under the management of J. L. Bruce.

NEVADA

[illegible]

ARROWHEAD.—A cross-cut from the [illegible] level of the Arrowhead is nearing the extension of the rich ore-shoot found on the 100-ft. level. The winze from the east drift on the 100-ft. level, now nearly 50 ft. deep, continues to expose exceedingly rich silver ore and Tonopah and Goldfield engineers who have visited the mine recently are highly pleased with general conditions. Ore in the bottom of the winze assays from $400 to $500, with numerous seams of pure ruby silver. The shaft of the Arrowhead Extension adjoining the Arrowhead on the east, is 50 ft. deep and indications are that the sulphide zone will soon be reached. The Arrowhead Ex. is regarded as the most promising prospect in the district. It is reported that the Arrowhead will soon start sinking a new shaft near the Extension line. The latest company to erect a head-frame and hoisting machinery is the Consolidated, one mile south-west of the Arrowhead.

CACTUS.—Sol Camp of Goldfield, superintendent of the January mine in the early days, who has been appointed superintendent for the Cactus Nevada Silver Mines Co., states that a contract soon will be let for sinking the main shaft of the company an additional 100 ft. to a total depth of 300 feet.

SILVER PEAK.—A cross-cut from the bottom of the 225 ft. shaft of the Allied Mining & Milling Co., operating 16 miles south of Silver Peak, has shown the vein to be 10 ft. wide, with samples containing 5 oz. silver per ton for this width. A drift has been started toward the extension of the ore-shoot developed on the upper levels.

EUREKA.—Sinking of the main winze from the 400-ft. level of the Eureka Croesus is to be discontinued at a depth of 300 ft. No further work will be done in the winze until the shaft has been sunk from 700 to 800 ft. and the workings drained to this depth, when the winze and the shaft will be connected. Work at other points in the mine is adding to the ore resources rapidly and shipments average from 750 to 1000 tons monthly. A vertical winze, in addition to one following the ore, is being sunk to the 'cave' orebody opened at a depth of 200 ft. in the California claim, at a point south-west of the Catlin, or main shaft. This orebody assays over $150 per ton for a width of 8 ft. Ore averaging from $50 to $75 per ton is being broken from five faces on the 400-ft. level.

MONTEZUMA.—After having been idle for over two months, during which the owners considered the alternatives of selling or continuing development, work has been resumed on the Monitor group of claims. A cross-cut has been started from the bottom of the 100-ft. shaft to cut veins parallel to that in which the shaft is sunk. From 3 to 3½ ft. of silver-lead ore assaying from $75 to $150 per ton is exposed in drifts that have been driven short distances into the ore-shoot on the 50 and 100-ft. levels. Goldfield engineers say the Monitor is one of the best developed prospects in the southern part of the State. O. R. Whitaker has done practically all the work.

TULE CANYON.—Harry Stimler and a party of New Yorkers recently visited Tule canyon. They are reported to have paid $1000 for a fractional claim between the Ingalls mine and the White and Jaggers groups and it is said that a deal involving the sale of these two groups and possibly the Ingalls is under consideration. A 5-stamp concentrator is being built on the Benton lode claims, near the northern end of the canyon. The canyon remains dry and no placer mining is being done.

TONOPAH.—It is reported that the Millers plant of the Tonopah Mining Co. will re-open shortly after the first of the year. The plant, which has a capacity of 500 tons per day, has been idle for one year, during which time the company has shipped to the Belmont mill in Tonopah. The reason for the decision to re-open the plant is not known.

GOLDFIELD.—At a meeting of the stockholders of the Goldfield Development Co. the plans of the company for increasing the capitalization from 2,500,000 to 4,000,000 shares were approved. The 12 to 14-in. seam of ore assaying in places as high as $11,000 per ton found on the 250-ft. level of the Combination has been cut 50 ft. south of where it was first opened, the width and value being practically the same. From November 1 to December 20 three Florence lessees shipped ore of an estimated value of over $35,000, the Florence Divide, with over $25,000, being the principal producer. The southeast cross-cut being driven by the company on the 358-ft. level is 361 ft. long and the west cross-cut on the same level is 526 ft. long. A promising body of quartz on which it is planned to drift has been opened in the southeast cross-cut.

UTAH

SAFETY FIRST CONFERENCE — AGREEMENT REACHED BETWEEN PARK CITY COMPANIES.

SALT LAKE CITY.—A conference of safety engineers and other employees of local smelters and concentrating plants engaged in welfare work, was held recently in the office of the State Mine Inspector, Carl A. Allen, at the State Capitol. J. C. Welsh of the International Smelting Co. at Tooele, lead the discussion, at the opening session, on dangers from smelter fumes. B. O. Johnson of the Midvale plant of the United States Smelting & Refining Co., had charge of the topic of safeguarding belts and moving machines. C. Chamberlain of the Murray plant of the A. S. & R. Co. spoke of electrical safeguards. The best methods of securing the co-operation of employees in safety work was the topic of R. U. Wood of the Garfield smelter. C. H. Wilson, safety engineer of the Utah Copper Co., took up the subject of relations between the safety inspector and the plant foreman. Dr. T. B. Beatty, State Health Commissioner, and Dr. A. L. Murray, of the United States Bureau of Mines, were interested participants in the discussion on the effect of smelter fumes.

A course in practical prospecting is to be given during the month of January by the Utah School of Mines. No laboratory fees will be charged, the only fee being a nominal one of $1 for registration, but it is expected that those who enroll will be genuinely interested in the course, which will begin January 5 and end January 31. It will comprise 36 lectures of one hour each and about 20 laboratory periods, each 3 hours in length. The course will cover the fundamentals of geology, mineralogy, mining, and the metallurgical treatment of ores.

After six weeks of legal battle in the United States District Court, the attorneys in the case of the Utah Consolidated Mining Co. against the Utah Apex Mining Co., involving property rights in the West Mountain mining district worth approximately $6,000,000, made final arrangements with the court concerning the arguments and shook hands. Three days, commencing Monday, January 26, have been set aside by the court for hearing the arguments, and many students of geology and mining lawyers will attend the court to listen to the ideas advanced. Both sides have had the services of the best mining and legal experts, and considerable interest is manifested in the final outcome of the case.

ALTA.—Development work carried on during the past three months at the South Hecla mine has been satisfactory, according to George H. Watson, the manager. Although shipments have been curtailed by lack of transportation facilities, the result of development work carried on in the interim has been satisfactory. Recent heavy storms have resulted in definitely suspending railroad operations for the winter, so that it will be necessary for local mines to send ore to the valley smelters by sleighs. This year, with an unusually heavy fall of snow, it may be possible to haul ore in this manner for three or four months.

Samples taken from the stope on the 200-ft. level of the Emma Silver mine show excellent ore, averaging from 36 to 107 oz. silver per ton. Arrangements have been made by George H. Dern, general manager, to begin hauling ore with sleighs as soon as the road can be opened up. When this is done, development work and the breaking of ore can be expedited. The present method of storing ore, while the bins are full, necessitates a second handling, but the management considers that as long as pumping operations must be maintained, some ore should be broken.

EUREKA.—Directors of the Tintic Standard Mining Co. met at Provo on December 12, and declared the regular quarterly dividend of 8c. per share, payable December 24. After the meeting it was announced that a special dividend will be decided upon December 22. The total dividends paid by this company to date amount to $682,456.

Ore shipments from the district for the week ending December 13 show a decrease of 5 cars from the previous week. The Chief Consolidated shipped 41 cars; Tintic Standard, 28; Iron Blossom, 13; Dragon, 12; Eagle & Blue Bell, 12; Colorado, 7; Centennial-Eureka, 6; Mammoth, 5; Grand Central, 4; Gemini, 4; Ridge & Valley, 3; Victoria, 3; Empire Mines 2; Gold Chain, 1; Swansea, 1; Utah Con., 1; total, 143.

A terrific gale struck this camp on the night of December 12, doing considerable damage in the town and

surrounding country. At the Chief Consolidated's plant two 50 ft. smoke stacks fell over, and a 75 ft. bridge at the Eagle & Blue Bell was blown from its foundations. Power and telephone lines also were put out of commission.

PARK CITY.—All litigation, present or threatened, between the Silver King Coalition Mines Co. and the Keystone Mining Co., two of the largest companies in the district, is eliminated as the result of an agreement recently entered into. The following announcement was made by officials of the Silver King company: "A settlement of pending and threatened litigation has just been consummated among several mining properties in this district which are, and may be, a matter of controversy. It is understood that in addition to the grants and releases, the Keystone company receives a substantial cash consideration, the amount of which is not disclosed.

The Daly Mining Co. has declared its 91st dividend, of 10c. per share, payable January 2. This will call for the payment of $15,000, making a total of $112,000 for the year and a grand total to date of $3,142,000.

STOCKTON.—The work of repairing the shaft at the Stockton Standard mine is going forward rapidly. Recently, officials of the company decided that it would be advisable to replace the shaft timbering, which was settling and becoming weak. By the first of the year the

LEXINGTON MOUNTAIN, NORTH-WEST KOOTENAY, BRITISH COLUMBIA

which is of general interest to the public and of special interest to the stockholders of the Silver King Coalition Mines Co. and the Keystone Mining Co., and the estates of David Keith and Thomas Kearns. All litigation, actual and threatened, is eliminated, and certain rights and easements are mutually granted, which are of great present and future value in the development of the interests concerned. The Coalition company dismisses all actions against the Keystone company, involving apex rights and grants, and grants on a rental basis, easements through certain of its workings, through which the Keystone company can at once proceed to extract ore and develop its property. The Keystone Mining Co. dismisses its action involving the Crescent fissure and its proceedings for condemnation of right-of-way through Silver King Coalition ground, and releases certain additional extralateral rights to the Silver King Coalition company expects to have this completed and a new gas engine in place, according to J. C. Fleury, manager. As soon as the above improvements are completed, the management will speed the work of developing the orebody encountered this fall. This orebody, assaying high in silver and lead, has been drifted along for a distance of 55 ft. and found to be continuous. At the junction of an east-west break with a north-south fissure, a winze was sunk to a depth of 25 ft., all in ore.

BRITISH COLUMBIA

PREMIER PLANS TO SHIP. -NEW MILLS IN SANDON DISTRICT.

SLOCAN.—The Standard Silver Lead Mining Co. has developed a new ore-shoot between the fifth and seventh levels. The shoot is over 300 ft. long, 12 to 14 ft. wide, and assays 16% zinc and 5% lead, besides containing

carrying quantities of silver. Already nearly 3000 tons of concentrate has been shipped. During the strike at the Consolidated M. & S. Co., the Sullivan mine, at Kimberley, the mines of the Slocan district, were able to dispose of the concentrates, which had accumulated over a considerable period for want of a market. The strike is now settled, and the Sullivan, with the improvements that are being made, will turn out more zinc concentrate than ever before.

ALBERTA.—The extensive oil deposits believed to occur in the Great Slave Lake and Peace River districts of northern Alberta have attracted the attention of several large oil companies, including the Standard, the Shell, and the Anglo-Canadian, the last two controlled by British interests. These concerns, as well as a number of smaller companies, are preparing to send out prospectors and drilling outfits as soon as navigation opens.

SKEENA.—The Belmont-Surf Inlet Mining Co. is emulating the Granby Consolidated M. S. & P. Co. in improving the living conditions of its men. A model town is being built at the mines, comprising homes and public buildings that are lighted by electricity and heated by steam. There is little doubt that the excellent feeling that exists between the Granby company and its employees is due to the considerate and fair way in which the men are treated.

TRAIL.—The Consolidated company has declared the usual quarterly dividend of 2½%, payable January 2 to stockholders on record December 10. The disbursement amounts to $261,963, bringing the total up to $6,305,275. C. A. Seaton, of the Sullivan mine staff, has been appointed manager of the Molly Gibson mine.

YALE.—A new compressor has been installed at the Donohoe mine, Stump lake. Diamond-drilling operations have been started at the Aspen Grove mines, Stump lake, under the supervision of M. H. McLeas, of Santa Barbara. A discovery of vanadium ore is reported from the Aspen Grove district.

PRINCETON.—Work at both the mine and mill of the Canada Copper Corporation's plant, practically has been suspended until the completion of the railway. But for the strike during four months of the past summer, the railway would have been completed, and the company would have been giving employment to 700 men this winter.

STEWART.—With a large tractor, in conjunction with its own teams as well as those of the Bush Ltd., Forty Nine, and other companies, it is expected that some 3000 tons of ore will be shipped by the Premier Mining Co. this winter. The road is in excellent condition, the ground having been frozen before the first snowfall. W. A. Mellochc, of New York, is said to have secured an option on the George copper group, owned by W. B. George of Stewart and R. George of Vancouver. It is understood that a diamond drill will be put on development work in the spring.

QUESNEL.—Construction plans in connection with the extension by the British Columbia government of the Pacific Great Eastern Railway into the northern section of the Province, with the object ultimately of tapping the Peace River region, are being watched by those interested in the opening of the vast mining area lying some 60 miles east of the line as now located. At Boullion, Hydraulic, Quesnel Forks, Keithley Creek, Barkerville, Stanley, and Wyngdam many properties are in need of transportation facilities. New York operators at Wyngdam were compelled to haul machinery, including a large boiler, from Ashcroft up the Cariboo road for a distance of 260 miles, 14 teams being employed in the work.

HAZELTON.—The Delta property, situated on Rocher de Boule mountain, is to be re-opened and developed, the initial operations being carried on under W. G. Norrie-Loewenthal, superintendent of the Silver Standard at Glen Mountain. Mr. Norrie-Loewenthal will lay out the plan of development and give as much of his time as is necessary to its direction. Work already has been done on the Highland Boy property, which adjoins the Delta, some high-grade ore being exposed.

SANDON.—On the Noble Five and the Reno properties, acquired and consolidated by James Dunsmuir, of Victoria, the newly constructed 100-ton concentrator, which started early in July, is handling the mine output satisfactorily. This mill provides for concentration by flotation, jigs being used in the first stages of the process. There is also a new 150-ton concentrator, built by Clarence Cunningham at Alamo. Among the properties operated by Cunningham, which probably will contribute ore to this mill, are: the Queen Bess, Idaho-Alamo, Wonderful, and Sovereign. At the last two, tramways have been built connecting them with the railway. The Roseberry-Surprise Mining Co. has been the district's banner producer, at the same time having been actively engaged in development work at the Surprise, Bosun, and Ivanhoe properties.

WINDERMERE DIVISION.—The Paradise mine has been operating steadily during the year and has maintained its average production, although somewhat handicapped by labor conditions. New development work is being done on the lower workings which promises well. The Trojan Mining Co. is developing its properties on Boulder creek and small shipments have been made from the Trojan and Sitting Bull properties. The Lead Queen, on 'Number 3' creek, has been purchased by Paul Dernhart, of Seattle, and 40 tons of high-grade silver-lead ore has been shipped. Present work consists of driving a cross-cut to develop the vein at a greater depth. Mr. Dernhart also recently acquired the Isaac property on the same creek.

GOLDEN.—The Couverapee mine has been temporarily idle because of a dispute as to the boundary lines between that property and the Monarch mine. Recently it has been reported that the two have amalgamated and that shipments to Trail have been resumed. C. J. Lincke, who is operating some claims on the Middle Fork of the Spillimacheen river, is understood to be making arrangement to pack out copper ore. The Rose and Daisy claims, formerly known as the I. X. L. and Condor, have been bonded to a company which is reported to have put a small crew of men to work.

ONTARIO

COBALT NOTES—HOLLINGER DIVIDEND

COBALT.—A number of silver producers are withholding shipments of bullion on the strength of the belief that quotations will record another increase. The Canadian government has taken up the question of restoring the proportion of silver in Canadian coinage as a means of lessening the possibility of melting of coins.

The Beaver mine is reported to be earning from $2000 to $3000 per day. F. L. Culver, the president of the company, states that it is his intention to begin at the surface and mine the property all over again. This decision has been reached owing to recent exploration work, which revealed a large tonnage of medium-grade ore which was missed in the early stages of development when attention was concentrated chiefly on high-grade ore. The Temiskaming Mining Co. has declared a dividend of 4%. The company, after a successful year, has a surplus approximating $1,000,000. The Coniagas company will hold its annual meeting December 22. The output for the fiscal year ending October 31 amounts to 900,000 oz. with a value about equal to that of the preceding year. A decision has been handed down in connection with the boundary dispute between the O'Brien and the La Rose Consolidated companies. The action was dismissed and the costs assessed to the O'Brien company. A number of deals for property in the Gowganda silver district are being closed. The Trethewey company is preparing to send out a shipment of 20 tons of high-grade ore from its [illegible] property in Gowganda. The consolidation of the Hargraves and the Kirkpatrick properties has been completed and arrangements are now being made to commence work.

A material increase in ore and bullion shipments was reported last week, the consignments amounting to 243 tons. The Mining Corporation of Canada shipped 113,737 oz. of bullion. The Nipissing during November mined ore of an estimated value of $350,209 and shipped bullion from Nipissing and custom ore with an estimated net value of $[illegible]. The Crown Reserve has encountered some of the richest ore yet found in the mine at a depth of 150 ft. The vein is four inches wide. The Kerr Lake company during November produced approximately 115,000 oz. of silver, this being the record output for some months. Diamond-drilling operations are under way at the Advance from the 310-ft. level. The Northern Customs concentrator is repairing the equipment on the property recently purchased from the Chambers-Ferland company preparatory to starting operations.

STATION AT THE NORTH SHAFT, SAN JUAN LEVEL, EL ORO, MEXICO

PORCUPINE.—The output of the Hollinger Consolidated is the largest in its history. The dividend recently declared, which is the seventh during 1919, calls for the disbursement of $246,000, bringing the total payments for the year up to $1,722,000. Since the first operation of the mine in 1911 the total production has amounted approximately to $43,000,000. The Porcupine Crown is negotiating for the purchase of the Moneta property adjoining the Hollinger on the West. The Dome Lake mill is nearly completed and is expected to be in operation

before the end of the year. Carl Frank, formerly on the staff of the Dome Mines, is in charge of operations.

The Dome Mines continues to treat about 1000 tons of ore daily. The financial position of the company is being gradually strengthened and a dividend of 25c. per share will be disbursed on January 15.

Toronto.—All indications point to a great expansion in the gold and silver mining industries of Northern Ontario. The improvement in labor conditions, the importance of recent discoveries showing the feasibility of deep mining, and the fact that American money is at a premium in Canada, have drawn the attention of American investors to the opportunities offered by the gold and silver camps to an unprecedented extent. Large amounts of capital are being invested in mining properties and production is showing a steady increase. Next year will will witness a remarkable advance in the development of many new prospects, more especially in the newer fields.

Kirkland Lake.—The Lake Shore mine has been dewatered to the 300-ft. level. During November 570 tons of ore was milled with a production of bullion worth $10,246. Some high-grade ore has been encountered on the 700-ft. level of the Kirkland Lake, the deepest point of operation in the camp. The mill is treating an average of 150 tons per day. On the Canadian-Kirkland property, controlled by the Crown Reserve company of Cobalt, underground work has been started. Surface work indicates wide veins of ore of medium grade. The Ontario-Kirkland has obtained funds for development by the sale of 400,000 shares of treasury stock and underground work is being pushed.

Gowganda.—A number of properties in this district have changed hands and other deals are being negotiated. The Cartwright property at Bloom Lake has been optioned to Toronto interests at a high figure. The McAlpine claim has been purchased by John Oliver of Toronto. Ownership of the Everett claim adjacent to the Castle and probably containing a continuation of the vein system of the latter, is being negotiated for by a syndicate of which Sir Henry Pellatt, a prominent Toronto financier, is a leading member.

SONORA

NOTES OF SONORA ACTIVITY.

Alamos.—The La Prieta gold property in this district will be re-opened soon by Joseph L. Obermuller and L. H. Wilson and will operate on a larger scale than before. The 12-ton mill will be enlarged as soon as the necessary machinery and supplies are received. Navajoa is the nearest rail point. The people of this district are friendly to the mining industry and there is plenty of labor to be had at reasonable rates. The Promontorio Mines Co. and several smaller organizations are operating. Work hitherto interfered with by the Yaqui Indians is expected to be resumed as the Indians are believed to have been crushed effectually by the campaign of the Government and State troops. The recent storming and capture of the strongholds at Bacatete and Bacatetito, with the result that 52 Indians were killed and more than 200 women and children taken prisoners, was the final stroke.

Cananea.—The Cananea Consolidated Copper Co. has cut its production to three and a quarter million pounds, which will be maintained indefinitely.

Nacozari.—R. C. Williams, of Baltimore, Maryland, has taken a bond on the Virgin de Plata group of claims, a promising silver prospect 17 miles south-east of here, from J. H. Canon of El Paso, S. W. White of Douglas, and C. H. Cartee of Baltimore, Maryland. Mining and development work will be started with Joe Adair in charge. The main vein has been developed from a few inches wide at the surface to more than four feet at the 110-ft. level. A shipment of ore will be sent to the smelter at El Paso. Mr. Williams, who has been examining other properties in this district and southern Arizona, in behalf of wealthy Eastern clients, will return to this district shortly after the New Year.

Progresso.—The Progresso Silver Mines Co., operating near Batuc, is shipping two Pachuca and one Dorr cyanide tanks from the border to its property. The scope of its mill operations will be enlarged now that water concentration and cyaniding have proved entirely successful. The property is shipping bullion weekly to the Selby refinery in San Francisco.

Moctezuma.—R. R. Belknap, formerly engineer for the Shattuck Arizona mine at Bisbee, will arrive at the Con. Virginia mine situated in the south-eastern part of the Moctezuma district soon after January 1, intending to put to work a force of 20 men on development. The Con. Virginia was bonded recently by Ygnacio Soto to L. C. Shattuck of Bisbee. Several hundred feet of work was done on the ground by the late Carlos C. Soto before war conditions forced him to abandon it temporarily. Con. Virginia is a silver-gold property and has surface indications which promise permanency in the deposit. It is probable that the Con. Virginia will ship and receive supplies by way of Pearson, Chihuahua, 60 miles north-east.

An important decision has been rendered by the State Legislature in the county-seat fight between Moctezuma and Cumpas, when the members of the Congress decided that the former was entitled to be the capital of the Ninth District of Sonora. The mineral agency, stamp offices, court of the first instance and county officers soon will move back here. The county seat formerly was situated in Moctezuma, but was removed by the Constitutionalists several years ago.

Cumpas.—High-graders attracted by the high price of silver are said to be working a number of properties in this vicinity, extracting high-grade ore and selling it to ore buyers at the border. There have been a number of thefts of ore and concentrate in transit reported to the county officials here.

Mina Mexico.—A force of miners has been put to work preparing for the re-opening of this property after its long close-down. Machinery for the 50-ton flotation plant has been shipped from El Paso and is on the way to the mine. Most of it will have to be freighted by pack train from Moctezuma to this point.

ARIZONA

Globe.—The first annual convention of the Southwestern District of the American Association of Engineers will be held here on January 9, 10, and 11, with members of the Globe-Miami chapter acting as hosts.

Business meetings and inspection trips to the various mines and mills in the vicinity will occupy the first two days and a trip to the Roosevelt dam will be a feature of the third day. A smoker will be given at the Old Dominion library the first evening and the delegates will banquet at the Miami Y. M. C. A. on the evening of January 10.

The Southwestern Society of Engineers with a membership of over 400 engineers from Arizona, New Mexico, and Texas recently affiliated with the American Association of Engineers. G. Montague Butler, Director of the Arizona Bureau of Mines and Dean of the Engineering College of the University of Arizona, was president of the former organization and now holds the same office in the Southwestern District of the American Association of Engineers.

Kingman.—Hill and Mattson, who are leasing the Antler and Copper World mines situated in the Yucca district, are shipping ore that assays 14% copper and 2½ oz. silver. Recent development has opened a rich streak of copper-silver ore.

The 'apex' cases of the United Eastern Mining Co. against the Tom Reed company, involving the orebodies on the Big Jim claim, which were to come up for trial in the Superior Court in the September session, are now to be tried in January by consent of parties. Extensive work by both companies has been done to prove their cases.

Mayer. It is announced by W. H. Skinner, president of the Pocahontas Mining Co., that the new 50-ton mill has been completed and is ready for operation. This gold-silver-lead property has been under development at intervals during the past ten years.

Prescott.—The plans of the directors of the Grand Island Mining Co. are to sink a winze on the third tunnel level of the Mark Twain mine upon which the Grand Island has a bond and lease. Development to date has been favorable.

CALIFORNIA

Auburn.—Erection of a gasoline hoist and 10-stamp mill is proceeding at the Nevada Hill-Two Orphans property, recently acquired by E. F. Stephenson, of Auburn, and San Francisco associates. Both mines produced rich ore in pioneer times but have attracted little attention for 40 years. ——Prospecting of the Dan Kirby property, in the heart of Auburn, has been started by H. M. Chambers and William Kingsley. Indications are declared favorable for development of gold ore.

Brownsville.—Driving of the drainage tunnel is advancing steadily at the B. A. C. property, often known as the Solano Wonder. The operators were forced to cease work in the shaft two years ago because of water. Rich ore was produced from the surface workings. Major E. A. Hoeppner is manager.

Mariposa County.—R. O'Donald and Marcus Shinski have reported the discovery of platinum ore at their mine, located in Devil's gulch, about five miles from Jerseydale. Samples from a 4-ft. vein have assayed $37 per ton, principally in $44 in gold. The vein material contains tin, cobalt, nickel, and other metals. The Government experts report this ore as very much like the ore from the Ural mountains, the main source of our platinum supply. Should the discovery prove as valuable as is at present indicated, there is no doubt about the value of the property, as platinum is needed badly in the United States owing to the supply from Russia being cut off by the uncertain traffic conditions.

Nelson Point. The Gold Dust M. & M. Co. is completing plating erection of a 10-ton mill in the spring. A wagon road will be first built to the property from Nelson Point. A. E. Hildreth of Oakland is heavily interested.

IDAHO

Coeur d'Alene. The Hecla Mining Co., operating at Burke, has opened an orebody on the 2000-ft. level which is expected to add material to the ore reserves. The disclosure is reported to have been made on the No. 1 vein which is not to be confused with the 'east orebody', over the possession of which litigation has been started. Ground has been cleared and excavation has been completed for the new tunnel projected on the property of the Hypotheek Mining & Milling Co. and the work of driving the bore will be started at once, according to Otto A. Olson, manager. A blacksmith shop and other equipment has been installed. The report of the Alhambra Mining Co. owning property near Wardner shows: Total expenditures $168,326, of which $146,096 was on development account, $16,055 for general expenses, $1293 for surveying, and $2859 on patent account; receipts $168,326, of which $2501 was derived from the sale of ore and $165,000 from assessments. At a meeting of the directors of the Tamarack & Custer Consolidated Mining Co. a dividend of 3c. per share was declared, payable on December 24 to stockholders of record on December 13. The disbursement will amount to $53,250 and is the first dividend declared by the company this year.

MONTANA

Butte.—The Butte & Superior Mining Co. has filed its accounting setting forth the profits accruing through the infringement of the Minerals Separation North American Corporation flotation patents as being $451,000. The company states that the accounting was filed as an aid in determining, and not an admission of, the amount of recovery, if any, to which Minerals Separation may be entitled. Furthermore, the company does not admit that all gain and profit are legally attributable to invention of patent in the suit. It does claim and will try to prove that a large share of the profits was due to the company's own efforts.

NEVADA

Goodsprings.—A 5-ft. vein of copper ore has been found in the Azurite mine, 30 ft. below the stope which produced high-grade ore when worked under lease by Egger and Fredrickson. The discovery was made by W. E. Allen and W. Cooper, lessees. The ore is said to average above 10% copper.——The Singer property has been leased by J. A. Fredrickson and P. H. Springer, Jr.

Mina.—Our attention has been called to an error in the news from this district in the issue of December 13. It was stated that "a number of companies that started work at the height of activity in the district have suspended operations. This includes the West Extension." We have received a letter from the Mina Bureau of Mines, which states that there is no justification for this statement, and that "all the companies that were operating at the height of activities are still operating, notably the West Extension, which has been and is continuing its work with the usual force of men". We regret this error.

Pioche.—The Black Metals Mining Co. reports the discovery of rich silver-lead ore in its Day mine, at Jackrabbit. The ore was found north-west of the May Day vein on the 325-ft. level. Assays are said to range from 100 to 2000 oz. silver. Drifting has started to determine the extent of the orebody. George Snyder is general manager.——The lease operated on the Yuba mine, by Alexander Lloyd and W. D. Price, has exposed high-grade silver-lead ore. The discovery was made in the winze from the Pacific tunnel.——Shipments of the Prince Consolidated company are averaging 1450 tons per week. Development work in virgin ground continues satisfactory.

Reservation.—The Review Mining Co. has started driving a long tunnel to open veins at a depth of 500 ft. The property is traversed by a large silver-lead vein, striking north and south, and several cross-veins. Orders are to be placed for compressor, drills, and other machinery. George W. Howell, of Howell-Dormann Co., Oakland, California, is general manager.——The Elkton Divide Mining Co. has begun work on the Pinto claim leased from Reservation Hill company.

SOUTH DAKOTA

Lead.—The fire which has been burning in the Homestake mine since September 25 has been extinguished by flooding. It was necessary to flood the mine only to the 600-ft. level. The mine is now being rapidly unwatered and milling operations have already been resumed on ore being mined from the upper levels. Work on the flooded levels will be resumed as rapidly as the levels are unwatered, as the only effect of the flooding has been to cleanse the mine. The unwatering will require only a short time.

WASHINGTON

Spokane.—An offer of $100,000 for the Silver Queen and Snowstorm mining properties at Deer Trail in Stevens county, made by C. S. Turner, of Davenport, has been received by M. E. Jesseph, receiver. Until recent years operations on the property have been conducted by the Silver Basin Mining Co., of which Mr. Turner was president. The mine is familiarly known as the Silver Basin. It has produced $200,000 worth of ore.

The Electric Point Mining Co. is preparing for a steady production of ore in 1920, according to Roy A. Young, president. He expects to have the preparations completed by the holidays. The orebody opened recently at the surface has been tapped at the 50-ft. depth and a cross-cut on the 100-ft. level is approaching the ore.

BRITISH COLUMBIA

Trail.—Ore receipts at the Trail smelter of the Consolidated Mining & Smelting Co. for the week ending December 7 totalled 6229 tons. The chief independent shippers were as follows: Highland, Cedar Creek, 156 tons; Mountain Chief, Renata, 100 tons; North Star, Kimberley, 206 tons; Silversmith, Sandon, 144 tons; Standard, Silverton, 388 tons; Surprise, Roseberry, 246 tons; and Van Roi, Silverton, 46 tons. Of the company's mines the principal shippers were: Centre Star, Rossland, 2775 tons; Emma, Eholt, 553 tons; St. Eugene, Moyie, 250 tons; Sullivan, Kimberley, 1218 tons of zinc ore.

Personal

The Editor invites members of the profession to send particulars of their work and appointments. The information is interesting to our readers.

H. C. Hoover is spending the Christmas holiday at Palo Alto.

A. T. Watson has returned from New Zealand to San Francisco.

K. P. Swensen, representing the Horne Co., Ltd., is here from Tokyo, Japan.

Cecil A. Gorelangton has returned from China, and is now at Honolulu, in Hawaii.

H. D. Pallister is superintendent for the McKinney Steel Co., at Wolfpit, Kentucky.

P. R. Bradley, manager of the Alaska Treadwell and Alaska Juneau mines, spent the holidays in San Francisco.

E. A. Loring, of Bewick, Moreing & Co., London, is here on a visit to his father, **W. J. Loring,** who has returned from Boston.

R. H. Haffenreffer, Jr., president of the Utah-Apex Mining Co., left Salt Lake City on December 14 for his headquarters at Boston.

O. B. Perry is on his way to the Federated Malay States, in connection with the Guggenheim tin-dredging operations near Ipoh.

John T. Reid is visiting eastern Nevada, Utah, Montana, and Washington, and later New York. He will be away until next spring.

Carl B. Anderson, formerly with the Illinois Geological Survey and the Gulf Oil Corporation, has joined the staff of Rogers, Mayer & Ball.

Marion H. Foss, mining engineer of Salt Lake City, has accepted the position of manager for the New Life M. & M. Co., at Idaho Springs, Colorado.

H. Benton Leggat, consulting mining engineer for the Argyle Silver Mining Co., has returned to Salt Lake City after a trip to the company's property at Butte.

J. R. Harbottle, general manager for the Batopilas Mining Co., has gone from Silver City, New Mexico, to Batopilas, Chihuahua, Mexico, to resume operation of the mines.

H. V. Winchell, president, and **Bradley Stoughton,** secretary, of the Institute, addressed the San Francisco section in the evening of December 22, after a dinner at the Engineers Club. The occasion proved unusually interesting.

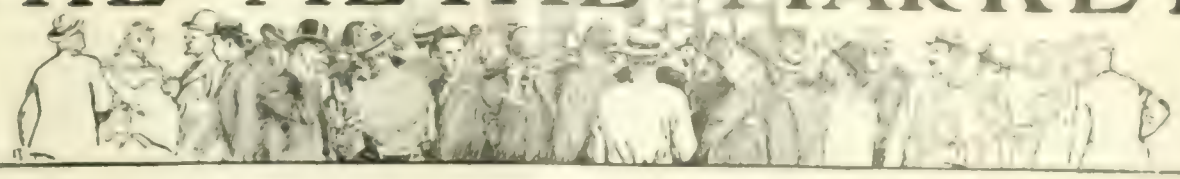
R. C. Gemmell, D. D. Moffatt, and **E. W. Engelmann,** of the Jackling porphyry properties, were in Nevada recently, inspecting the operations of the Nevada Con. Copper Co. **C. B. Lakenan,** general manager of the property, accompanied them from Salt Lake City.

J. L. Bruce has resigned as general manager for the Butte & Superior Mining Co. at Butte to accept a similar position with the Davis-Daly Mining Co. **Charles Bocking,** assistant manager, has been promoted to the position of manager for the Butte & Superior Co., effective January 1.

H. B. Tooker, for several years secretary to **D. C. Jackling,** has been appointed traffic manager of the Bingham & Garfield, Nevada Northern, and Ray & Gila Valley railways, effective on December 1. On January 1, Mr. Tooker will assume the same title with the Utah Copper, Chino Copper, Nevada Consolidated Copper, Ray Consolidated Copper, and Butte & Superior mining companies.

C. F. Jennings, of Salt Lake City, for some years assistant purchasing agent of the Jackling porphyry properties, as well as for the Butte & Superior Mining Co., the Alaska Gold Mines Co., the Bingham & Garfield Railway, the Nevada Northern Railroad, and the Ray & Gila Railroad, has been appointed general purchasing agent for all the above-named companies.

THE METAL MARKET



METAL PRICES

San Francisco, December 23

Aluminum dust, cents per pound	[illegible]
Antimony, cents per pound	10 [illegible]
Copper, electrolytic, cents per pound	[illegible]
Lead, pig, cents per pound	7.40—8.10
Platinum, pure, per ounce	$81.50
Platinum, 10% iridium, per ounce	$180
Quicksilver, per flask of 75 lb.	85
Spelter, cents per pound	10.00
Zinc dust, cents per pound	12.50—15.00

EASTERN METAL MARKET

(By wire from New York)

December 23—Copper is quiet [illegible]. Lead is active and firmer. Zinc [illegible] and firm.

SILVER

Below are given official or ticker quotations in cents per ounce of silver 999 fine. From April 23 1918 the United States government paid $1 per ounce for all silver purchased by it, fixing a maximum of $1.01½ on August 15 1918 and will continue to pay $1 until the quantity specified under the Act is purchased, probably extending over several years. On May 5 1919, all restrictions on the metal were removed, resulting in fluctuations. During the restricted period the British government fixed the maximum price five times, the last being on March 25 1919, on account of the low rate of sterling exchange, but removed all restrictions on May 10. The equivalent of dollar silver (1000 fine) in British currency is 46.65 pence per ounce (925 fine), calculated at the normal rate of exchange.

Dec.		New York cents	London pence
	17	133.50	78.00
	18	133.87	78.75
	19	134.00	78.50
	20	133.00	77.75
	21	Sunday	
	22	133.50	77.75
	23	133.50	77.75

Average week ending		Cents	Pence
Nov.	11	124.32	67.22
"	18	125.73	68.81
"	25	131.93	73.46
Dec.	2	132.00	73.50
"	9	131.29	74.75
"	16	131.29	77.38
"	23	133.56	78.08

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	75.14	88.72	101.12	July	78.92	99.62	106.36
Feb.	77.54	85.79	101.12	Aug.	85.40	100.31	111.45
Mch.	74.13	88.11	101.12	Sept.	100.73	101.12	113.92
Apr.	72.51	95.35	101.12	Oct.	87.38	101.12	119.10
May	74.61	99.50	107.23	Nov.	85.97	101.12	127.57
June	76.44	99.50	110.50	Dec.	85.97	101.12	

COPPER

Prices of electrolytic in New York, in cents per pound

Date Dec.		Average week ending
	17	18.75
	18	18.75
	19	18.75
	20	18.75
	21	Sunday
	22	18.75
	23	18.75

Average week ending		
Nov.	11	21.10
"	18	21.36
"	25	19.48
Dec.	2	18.55
"	9	18.21
"	16	18.50
"	23	18.75

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	29.53	23.50	20.43	July	29.67	26.00	20.82
Feb.	34.57	23.50	17.34	Aug.	27.42	26.00	22.51
Mch.	36.00	23.50	15.05	Sept.	25.11	26.00	22.10
Apr.	33.16	23.50	15.23	Oct.	23.50	26.00	21.66
May	31.69	23.50	15.91	Nov.	23.50	26.00	20.45
June	32.57	23.50	17.53	Dec.	23.50	26.00	

LEAD

Lead is quoted in cents per pound, New York delivery.

Date Dec.		
	17	7.15
	18	7.10
	19	7.25
	20	7.25
	21	Sunday
	22	7.30
	23	7.35

Average week ending		
Nov.	11	6.75
"	18	6.80
"	25	6.75
Dec.	2	6.75
"	9	6.85
"	16	6.99
"	23	7.05

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	7.64	6.85	5.60	July	10.93	8.03	5.53
Feb.	9.10	7.07	5.13	Aug.	10.75	8.05	5.78
Mch.	10.07	7.26	5.24	Sept.	9.07	8.05	6.02
Apr.	9.38	6.99	5.05	Oct.	6.97	8.05	6.40
May	10.29	6.88	5.04	Nov.	6.38	8.05	6.76
June	11.74	7.59	5.32	Dec.	6.49	6.90	

TIN

Prices in New York, in cents per pound:

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	44.10	85.13	71.50	July	62.60	93.00	70.11
Feb.	51.47	85.00	72.44	Aug.	62.53	91.33	69.20
Mch.	54.27	85.00	72.50	Sept.	61.54	80.40	55.79
Apr.	55.63	88.53	72.50	Oct.	62.24	78.82	54.82
May	63.21	100.01	72.50	Nov.	74.18	73.67	54.17
June	61.93	91.00	71.83	Dec.	85.00	71.52	

ZINC

Zinc is quoted per pound, New York delivery, [illegible] in cents per pound.

Date Dec.				
	17	[illegible]	Nov.	11 [illegible] 7.95
	18	[illegible]		18 [illegible] 8.05
	19	[illegible]		25 [illegible] 8.10
	20	[illegible]	Dec.	[illegible]
	21	Sunday		9 [illegible] 8.00
	22	[illegible]		16 [illegible] 8.00
	23	[illegible]		23 [illegible] 8.05

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	9.75	7.78	7.44	July	[illegible]	8.72	[illegible]
Feb.	10.45	7.97	6.71	Aug.	[illegible]	8.78	[illegible]
Mch.	10.78	7.67	[illegible]	Sept.	[illegible]	9.28	[illegible]
Apr.	10.20	7.04	6.49	Oct.	[illegible]	9.11	[illegible]
May	9.41	7.97	6.44	Nov.	[illegible]	[illegible]	8.12
June	9.63	7.97	6.91	Dec.	7.84	8.49	[illegible]

QUICKSILVER

The primary market for quicksilver is San Francisco, California being the largest producer. The price is fixed in the open market according to quantity. Prices, in dollars per flask of 75 pounds:

Date		
Nov.	[illegible]	75.00
Dec.	[illegible]	85.00

Dec.	[illegible]	[illegible]
	16	[illegible]
	[illegible]	[illegible]

Monthly averages

	1917	1918	1919		1917	1918	1919
Jan.	81.00	128.06	103.75	July	102.00	120.00	100.00
Feb.	126.25	118.00	90.00	Aug.	115.00	[illegible]	103.00
Mch.	113.75	112.00	[illegible]	Sept.	112.00	[illegible]	102.60
Apr.	114.50	115.00	73.12	Oct.	102.00	[illegible]	86.00
May	104.00	110.00	84.80	Nov.	102.50	120.00	[illegible]
June	85.00	112.00	94.40	Dec.	117.42	115.00	

MONEY AND EXCHANGE

The money market remains [illegible] with no indication of any material change in [illegible] to come. The policy of keeping the [illegible] and of this banking program will keep rates relatively high for some time to come. As a matter of fact, [illegible] markets. The former may eventually prove to have indulged in much more 'speculation' than the latter, while the process of liquidation is relatively much less easy. There is some sentiment being expressed for revision of [illegible] but rather as to the [illegible] would like to become 'country' places, while St. Louis, for example, would prefer to be a [illegible] deposit reserve from 13 to 10.

In a fresh decline in the foreign exchanges, sterling recently plunged through the $4 level. Defeat of the treaty and the steady pressure of commercial bills [illegible] may also be [illegible] 9.80 to the dollar. Some improvement may be hoped for as a result of a rumored British loan to France, and another $200,000,000 American loan to Great Britain. Some tangible evidence for belief in a compromise on the ratification of the peace treaty, would doubtless have a favorable influence.

Commenting on the exchange situation, one banker who has been in close touch with foreign markets for 40 years recently advanced the following line of argument:

"There is a [illegible] exchange in New York than the recent heavy offerings of merchandise bills. This decline by checking exports from America and encouraging imports will rapidly correct the enormous trade balance against England. Exchange at $3.70 amounts to a tariff on American shipments into England of 23%, and an export bounty of 23% on shipments from England here.

"If the readjustment of the merchandise movement were already completed, sterling exchange would still rule at a heavy discount. England is not on a gold basis. New gold as it arrives from the mines is dealt in freely in London at a large premium and can be shipped abroad, but the export of gold coin is prohibited.

England is [illegible] believe, but widely prevalent, as to her ultimate ability to discharge all her [illegible] travagance of the present British government. [illegible] excess of running expenses from revenue for the fiscal year 1919-1920 will add a further £475,000,000 to the British debt and the end is not yet in sight.

The British government [illegible] level."

Quotations on December 23 are as follows:

Sterling	Cable	[illegible] 3.83½
	Demand	[illegible]
Francs	Cable	[illegible]
	Demand	[illegible]
Lire	Demand	[illegible]
Marks		[illegible]

Eastern Metal Market

New York, December 16

The markets are all strong but only moderately active in most cases.

Better buying demand has caused copper to advance moderately. The low point is believed to have been reached a week ago at 18 cents.

The tin market has been quiet with sterling exchange values the ruling factor in price changes and in buying momentum.

The strength of the lead market is pronounced, outside selling prices making the market.

Prices for zinc are largely influenced by foreign demand which is subject to fluctuations in the pound sterling, England being the best buyer.

Antimony is quiet and firm.

IRON AND STEEL

The week has witnessed little change in the rate of steelworks operation, but pressure from consumers has grown decidedly. The latter, particularly the more important ones, realizing that the supply in the first half of 1920 will not be enough to go around, are redoubling their efforts to cover. Makers on the other hand are oversold for first quarter, and some for first half, and the fact that fuel costs have risen and may rise further is not a cheering factor.

The Government's 50% restriction in coking coal came off soon after the miners decision, on December 10, to return to work, and other limitations have also been removed. The distribution of coal, however, is still subject to regulation by the Railroad Administration and many iron and steel plants are still hampered and will be for some time.

The Steel Corporation and a few other producess are sticking to the prices of March 21, but, in spite of this, finished material tends to follow the advance in pig-iron. Yet the amount of unsold steel which the leading sellers can offer for the first half is relatively small.

Belgium has placed orders for 150 locomotives with the American builders and may buy 50 more. Germany will probably supply 200 to Belgium.

COPPER

After holding steady for most of last week at 18.50c., New York, electrolytic copper is again stronger on more active demand and is quoted today at 18.75 to 19c., New York, for December-January delivery. Sales of good proportions are reported at these prices to domestic consumers as well as to Japan and England. The former is again particularly active. Lake copper is more or less nominal at 19 to 19.25c., New York, for early delivery with some sellers reported out of the market. The settlement of the coal strike and the generally better labor outlook are favorable factors, but as yet buyers are not hurrying to cover until conditions are more settled. The general trend is much better and it is believed that the recent level of 18c., New York, has marked the low price for some time to come. As to Japanese buying, it is stated that for the five months ending with September, that country's importations of copper amounted to $10,826,000, as against only $250,000 in the 10 years ending with 1918. Japan's production of copper is said to have decreased while her consumption has increased.

TIN

The market has been quiet but it has been, and is daily, influenced and practically controlled by the value of sterling exchange. Business has been done each day, but because exchange values have fallen tin prices have also declined. Spot Straits last week went as low as 52.87½c., New York, from 54c. earlier in the week, but it has again become firm on better exchange values until yesterday it sold at 53.50 to 53.62½c., New York. For future shipment as high as 54.50 to 54.75c. is asked because of the stronger London market. All last week there was a mixed situation, due to the varied attitude of sellers. While the disposition to sell was general, some were willing to sell at current conditions and rates of exchange, while others were less inclined and held back. The higher London prices this week and the betterment in exchange values have caused the advance in New York, but buyers are more or less frightened and uncertain. The end of the coal strike is regarded as a bullish factor. Monday, December 15, the London market was £315 10s. per ton for spot Straits, equivalent to about 52.50c. per pound, with exchange at $3.74 per £1. Yesterday it had receded to £314 per ton. Arrivals thus far this month have been 3883 tons, of which 1090 tons came in at Pacific ports. Tin afloat is estimated at 4000 tons.

LEAD

The market is very strong, the controlling factor being a scarcity of supplies. On December 12 the American Smelting & Refining Co. again advanced its price from 6.90 to 7c., New York, but the outside market had already reached this level. It has in fact again gone higher than the official price and today is up to 7.15c., New York, or 6.90c., St. Louis, which we quote as the market, it being understood that the leading interest is virtually out of the market. One seller states that sales have been made as high as 7.25c., New York, and that it is not at all improbable that the leading interest will again advance its price shortly. Stocks of virgin lead held by the British government on December 1 were 59,912 gross tons, a reduction of 4920 tons during November.

ZINC

With the easing in the value of sterling exchange the past week there has been a corresponding decline in the quotations for zinc, this market, like the tin market, being largely controlled by the factor of exchange. It happens that in the case of zinc, foreign demand, particularly from British sources, is heavier than domestic demand. In the last few months it is stated that from 10,000 to 12,000 tons of zinc has been exported each month to England. Japan has also been an important buyer. Producers are comfortably sold up well into the first quarter and are not eager to book heavily, for they regard the future as holding out bullish inducements. A week ago prime Western for December and first quarter delivery was selling at 8.35 to 8.40c., St. Louis, or 8.70 to 8.75c., New York, but with the fall in the pound sterling and the consequent slackening in foreign demand, prices have nominally declined until today the quotation is about 8.25c., St. Louis, or 8.60c., New York, for the same delivery.

ANTIMONY

The market is quiet and fairly strong at 9.62½c., New York, duty paid, for wholesale lots for early delivery.

ALUMINUM

No change has been recorded. Virgin metal is quoted nominally at 32 to 33c., New York, for wholesale lots for early delivery.

ORES

Molybdenum: The market is inactive and quotations are nominal at 75c. per pound of MoS_2 in 90% concentrates.

Manganese: Indian manganese ore is offered at a minimum of 72c. per unit, c.i.f., but buyers are not willing to meet this price. It is believed that consumers would pay as high as 60c. per unit.

Company Reports

EL TIRO LEASING COMPANY

Report for quarter ending September 30, 1919.

Property: leases on various properties at Silver Bell, Pima county, Arizona.

Operating Official: Percy Williams, manager.

Financial Statement: operating profit $24,826; exhaustion expense $8744, net profit $16,081.

Dividends: $2000 to date.

Production: 31 cars or 1532 tons. Copper content 249,-277 pounds.

SHATTUCK ARIZONA COPPER COMPANY

Report for quarter ending September 30, 1919.

Property: mine and mill at Bisbee, Arizona.

Operating Official: Arthur Houle, superintendent.

Financial Statement: gross income, $310,626; expense, $237,993; depreciation charged off, $18,329; net income, $54,303.

Dividends: in 1919, $437,500; total to date, $7,525,000.

Development: 716 ft. of development driving on the 100, 300, and 500-ft. levels disclosed no new copper ore.

Production: dry tons copper ore smelted, 2498; dry tons lead concentrates smelted, 2783. Metals recovered: copper, 456,439 lb.; lead, 1,479,828 lb.; silver, 100,408 oz.; gold, 695 ounces.

ALASKA GOLD MINES COMPANY

Report for quarter ending September 30, 1919.

Property: The Alaska Gastineau Mining Co., which owns mines and mill near Juneau, Alaska.

Operating Officials: B. L. Thane, manager; G. T. Jackson, assistant manager.

Financial Statement: operating loss for third quarter $27,289, as compared with $56,483 for second and $106,784 for first quarter.

Dividends: None.

Development: large orebodies both east and west of main cross-cut on No. 13 level have been proved.

Production: 532,142 tons of ore milled, of a gross value of $0.90. Recovery was $0.73 per ton; extraction, 81.34%; value of bullion produced, $393,318.

DAVIS-DALY COPPER COMPANY

Report for quarter ending September 30, 1919.

Property: mine at Butte, Montana.

Operating Officials: James L. Bruce, general manager; William L. Creden, consulting engineer; William Frazier, mine superintendent.

Financial Statement: total receipts for the quarter amounted to $669,478; disbursements, $304,946; net profit, $364,532; cash and quick assets on September 30, $736,854.

Dividends: none in 1919. Total to date, $450,000.

Development: shaft-sinking has been completed to a depth of 2700 ft. Total development footage for the quarter, 2257 ft. New ore-bins and hoisting-equipment have been erected.

Production: shipments for the quarter amounted to 21,850 tons, producing 3,230,000 lb. of copper and 126,000 oz. of silver. The average tenor of ore shipped was 7.46% copper.

CHIEF CONSOLIDATED MINING COMPANY

Report for the quarter ending September 30, 1919.

Property: mine in the Tintic district, Utah.

Operating Officials: Walter Fitch, president and general manager. Cecil Fitch, assistant manager and superintendent.

Financial Statement: During the quarter 16,179 tons of ore mined [illegible] other [illegible] current assets [illegible] current liabilities [illegible] Bonds, $505,500; current liabilities, $109,865.

Dividends: [illegible] the total to date $1,517,825.

Development: [illegible] No. 3 crosscuts [illegible] ft. Diamond drill operations [illegible] times.

Production: [illegible] silver, 873,417 oz.; lead, 1,944,307 lb.; and copper, 3288 lb.; gross value per ton, $69.22; smelting, freight, and sampling, $21.75 per ton; average net value, $47.47. Total tonnage, 16,179.

BUTTE & SUPERIOR MINING COMPANY

Report for quarter ending September 30, 1919.

Property: mine and mill at Butte, Montana.

Operating Officials: J. L. Bruce, general manager; Charles Bocking, assistant manager; A. B. McLeod, mine superintendent; E. V. Daveler, mill superintendent.

Financial Statement: gross income, $1,376,673; operating costs, taxes, etc., $1,076,390; profit, $300,283, as against $210,226 for preceding quarter. Butte & Superior paid $2,500,000 to Clark-Montana Realty Co. in settlement of apex litigation.

Dividends: no dividends in 1919. Total to date, $16,940,-258. Dividends cannot be paid till after conculsion of Minerals Separation litigation.

Development: 5566 ft. of drifts, cross-cuts, and raises were driven on levels from 800 ft. to 2050 ft. Ore-reserves depleted by loss of certain portions of the ore deposits to the Clark interests.

Production: dry tons milled, 106,645; average zinc content, 14.168%; average silver content, 6.128 oz per ton; total zinc in concentrates, 28,978,051 lb. Wages were raised $1 per day July 1. Mining cost $6.68; milling cost $2.68.

CONSOLIDATED COPPERMINES COMPANY

Report for fiscal year ending April 30, 1919.

Property: mines and concentrator at Kimberly, Nevada. Control of Giroux Consolidated Mines Co. and the Butte & Ely Co. Also properties in Mexico.

Operating Official: H. S. Munroe, general manager.

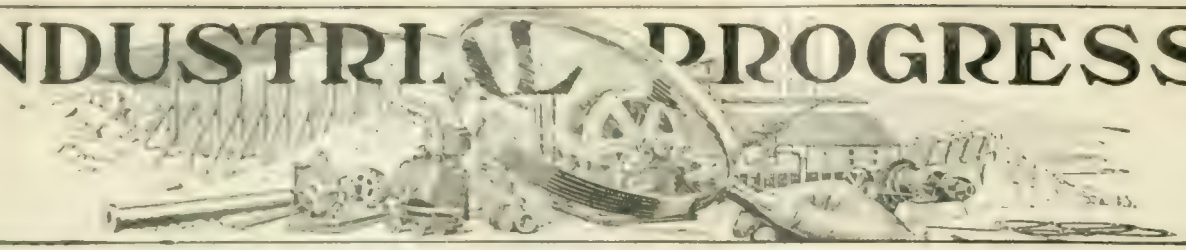
Financial Statement: net earnings on Nevada operations amounting to $45,429 were more than offset by deficits of $111,994 and $34,811. Combined statement of current assets and liabilities of Coppermines and Giroux shows $1,992,923 and $1,538,921, an excess of assets amounting to $454,001.

Dividends: none.

Development: in the Morris-Brooks mine 17,146 ft. of development was done in preparing mine for economical ore extraction. In the Alpha mine the most important discoveries have been on the 1200-ft. level. Other work has been done on 1000, 1100, and 1300-ft. levels. Ore-reserves include 10,000,000 tons, 1.41% copper; 10,000,000 tons, 1.25%; 156,000 tons, 3.21%; and 100,000 tons, 8.00% oxidized material.

Operations: 263,207 tons of ore containing 6,475,296 lb. copper was concentrated with a recovery of 5,197,000 lb.; 2806 oz. gold and 6234 oz. silver. Nevada Consolidated treated 201,198 tons of 1.52% ore, recovering 64% of the copper. A change in flotation reagents, from coal-tar mixture to alpha-naphthalamene and xylidin in an alkaline circuit effected economies by giving a higher grade and lower moisture. No ore has been produced since the middle of February.

INDUSTRIAL PROGRESS



INFORMATION FURNISHED BY MANUFACTURERS

MARCHANT PLANT TO MANUFACTURE AT ONCE

The Marchant Calculating Machine Co. plant at Emeryville, Oakland, California which was partly destroyed by fire, is already being re-built and in 60 days will again be manufacturing calculating machines, as the most important tools, dies, and jigs were saved. The plant was built in 1915 and production had just reached the highest point in the history of the company. It was considered by Government officials to house the finest and most complete tool and die department in the West.

A recent change in manufacturing methods demanded the installation of new automatic machinery which was on its way to the west coast at the time of the conflagration. This machinery will be erected in temporary quarters until the reconstructed units are finished.

The officers and directors are endeavoring to divert what stock is immediately available to the large centres where the demand for the Marchant has been greater than ever before. Service stations will be maintained in the principal centres, and the Marchant Calculating Machine Co. will endeavor to render as nearly 100% service as circumstances permit.

COMMERCIAL PARAGRAPHS

L. D. Knight, manager for the Ingersoll-Rand Drill Co. in Michigan for the past two years, has been promoted to the position of manager in charge of the business in Montana, with headquarters at Butte.

Walter Fitch, mining contractor, has returned to his headquarters at Eureka, Utah, for a short visit. He is now engaged on a large contract in Pennsylvania, which will require two years to complete.

O. H. Johnson, who has been manager of the Marcy mill department of the **Mine & Smelter Supply Co.** is no longer with the company. Mr. Johnson will announce his plans in the near future; in the meantime his address will be 1339 Clayton St., Denver, Colorado.

W. L. Penick, until recently connected with the Salt Lake City office of the **Hardinge Conical Mill Co.**, has been advanced to the position of North-West sales manager, and has gone to Spokane, Washington, to open a new branch office for the Hardinge Conical Mill Company.

W. J. McRae, formerly with the Sullivan Machinery Co. and now in charge of the Mining Machinery Department of Andersen, Meyer & Co., Shanghai, China, has been in the United States the past three months. He sailed from San Francisco to Shanghai on the steamer 'Colombia,' on December 17.

Russell W. Stovel has been appointed consulting engineer to **Westinghouse, Church, Kerr & Co.**, New York. Mr. Stovel has had a comprehensive experience in the mechanical and electrical problems connected with central power-station and steam-railroad electrification work, as well as experience in the mechanical handling of freight at water terminals. With the American Expeditionary Forces in France, Lieutenant-Colonel Stovel served as Chief of the Terminal Facilities Division of the Army Transport Service, one of the two big divisions of transportation of which Brigadier-General Atterbury was the Chief.

The fall Yuba bulletin is devoted to a description of Yuba tractors from the viewpoint of the man who is considering their use for farm purposes, yet it contains much that will be of interest to the mining man who has haulage problems over terrain that prohibits the use of the ordinary motor-truck. A draw-bar pull of 4600 lb. at a speed of 2½ miles per hour has many applications besides plowing a field.

The machinery house of **Smith-Booth-Usher Co.** has moved its San Francisco office from the Rialto Bdg. to 40-42 Fremont St., where it has leased larger quarters. By combining warehouse, store-room, and general offices at Fremont St., the company expects to be in a better position than ever to take care of its increasing business. A complete line of supplies, including contractors equipment and machine tools, is carried. Houses are also maintained in Los Angeles and Taft.

The Chicago Pneumatic Tool Co. reports orders booked during the month of October in excess of any previous month since the Armistice. The same is true of its English and German subsidiaries. Although the German subsidiary was seized by the German government and has been run under "compulsory administration" since the United States participation in the War, compulsory administration has now been abolished and the management is being transferred back to the C. P. T. Co. through the Courts of Commerce, according to cable reports just received from the company's representative now returning from Berlin. Reports show the German company was well managed during the War and is now operating on a satisfactory basis. Arrangements have been made to increase production materially.

An announcement of interest to users of transmission belting in the Middle West, is that of the **Gandy Belting Co.**, of Baltimore, Maryland, regarding the establishment of a Chicago branch. The new branch, which will be opened in the near future, is expected to carry one of the largest and most complete stocks of belting in the country. It will be situated at 549 Washington street, in the heart of the machinery district. In opening a branch at Chicago, the Gandy Belting Co. expects, in addition to a prompt filling of its orders from that city, to increase the efficiency of the service for which Gandy has always been noted. Fielder I. Schillinberg, Jr., who has been in charge at the New York office of the company, has been transferred to Chicago where he will act as manager of the new branch. Speaking of the need for a new service station one of the Gandy officials said: "Under the spur of reconstruction, mechanical activity has increased enormously and its pressing needs can be adequately met only by prompt efficient service; complete stocks near at hand for the quick filling of orders. Gandy service has kept pace with industrial growth for more than forty years and the establishment of our new branch in Chicago is a logical step in the development of a big enterprise to meet the increasing demands for Gandy belts in the industrial and farm power machinery fields."